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Psychological Bulletin

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THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

HISTORICAL CONTRIBUTIONS

BY WOODBRIDGE RILEY

Vassar College

In the quarter centenary of the founding of the American Psychological Association the year 1917 is signalized by a variety of valuable retrospects. Jastrow (4) vividly portrays pioneer days in the development of our psychology, Johns Hopkins University being its rallying point, George T. Ladd's text book its first monumental work, and William James the genius who guided its early destinies. Here there have been five overlapping waves: (1) the direct analytical interest of the man of the laboratory; (2) the comparative interest which has yielded its interpretative product in the behaviorist position; (3) the growth of applied psychology from advertising to education, with an overgrowth which threatens to make our people efficient though incompetent; (4) concern with the abnormal, from the early "ghost hunting" of psychical research to the present Freudian psychoanalysis; (5) social psychology where the laboratory with its simplified and scheduled analyses finds its corrective in the intricate worldly composite of conflicting forces. G. Stanley Hall (3) recalls the opposition—twenty five years ago—to German philosophy as pantheistic, to experimental psychology as materialistic as instanced by the criticism of President McCosh of Princeton of Hall's laboratory at Hopkins. An interesting account is given of the early struggles of the *American Journal of Psychology*, and of the first membership of the American Psychological Association. Pillsbury (5) contrasts the state of the different branches of psychology in 1892 with the present. Then, educational problems were still treated in an a priori way;

psychiatry was influenced by Kraepelin, but the experimental study of the mental processes of the insane was hardly begun; animal psychology was largely a collection of anecdotes. Now, education is illuminated by the study of the child under the questionnaire method of and Hall, the statistical methods of Pearson; psychiatry by such establishments as the McLean Hospital, and by the clinical study of hysteria, to some degree by the Freudian psychoanalysis, and especially by the Binet and Simon tests of intelligence, which sociologically has correlated crime and poverty with mental incapacity. Finally animal psychology, beginning with Thorndike's method of trial and error has eventuated in the contributions of the behaviorists. Cowles (1) describes the general position of psychiatry in America in its theory and practice (1880-1890). (1) Alienists were then subject, by general consent, to the claims of pathological anatomy as the master science in general pathology. Twenty years later it was concluded that this was of more academic than practical interest to the psychiatrist. (2) Mental physiology was then a desideratum for true explaining principles and the alienists avoided the speculations of academic psychology which gave little aid. (3) The physical conditions associated with mental diseases, led to systems of classification based upon the etiology of mental disorders as sequences of general diseases. (4) Most significant was the adoption of the "supporting treatment," as a basis of the neurasthenic concept developed in the science of neurology. This led to the establishment of such a laboratory of bio-chemistry as that at McLean Hospital. This combination of psychology and chemistry with pathology is traced through various institutions to the present time.

As a summary of the last quarter century Washburn (8) points out how far psychology has enlarged its field of observation. The advance into new regions is suggested by a comparative study of the first volume of *The Psychological Index*, and the last volume. Unknown to the first volume were such headings as these: social psychology, educational psychology, psychoanalysis, psychology of values, psychology of testimony, religion and myths, advertising. Besides enlarging its field psychology has improved its methods of observation, such as the formulas for calculating correlation, the technique of studies on the sensory discrimination of animals and the increased emphasis upon introspection as a supplement to objective methods.

As a complement to the above, Franz (2) investigates the scientific productivity of American professional psychologists. This has been better dealt with in an impersonal way. Cattell's scheme was an

attempt to grade psychologists by the votes of a few selected individuals. Advances have been made by our psychologists, but by whom have the advances been made, and in what manner have individuals or groups contributed to that advance? For the decade 1906-1915 Franz offers such tables as these: (1) the kinds of published contributions; (2) the grouping of published contributions according to the yearly number of publications; (3) the numbers of expected contributors, or actual contributors, or those contributing articles and monographs; (4) the distribution of psychologists; (5) comparison of totals of contributions by the older and younger groups. Based on the *Psychological Index* some results are these: (1) the notable decrease in 1914 is unexplained, the European war not affecting American psychologists; (2) and (3) the average of contributions of the older men was double that of the younger; but from (4) and (5) this is discounted by the fact that the older group has the advantage of professional and mechanical assistance, and less labor in teaching.

As to the correlations between psychology and philosophy Sabine (6) claims that between 1850 and 1890 metaphysics was at a low ebb because of the lack of coördination with the sciences. But in the last twenty-five years there have been established relationships between biology and psychology, and psychology and philosophy superseding the deadening influence of Neo-Hegelianism, so prevalent in England and America. The artificial and unwholesome disorganization between psychology and philosophy under which parallelism flourished has been preceded by an effort to show the part played by mental operations in the total functioning of the organism. Similarly Tufts (7) maintains that in the last quarter century ethics has passed from the old categories, from Sidgwick to Paulsen, into a genetic study of morality. This has the advantage both of the wealth of new material offered by anthropology and of the methods of interpretation suggested by social psychology. From the standpoint of evolution ethics has ranged from the ultra-Darwinism of Nietzsche, to the recent views on value, where there is an increasing element of controlling the situation, and not simply of adaptation to it.

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GENERAL STANDPOINTS: MIND AND BODY

BY WALTER T. MARVIN

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During the past year behaviorism has continued to be a prominent subject of discussion. Watson (17) has attempted to formulate the scope of behavior psychology in an article whose material is to be used in the introductory chapter of his forthcoming book, *Human Psychology*. He describes the procedure of common sense, the procedure of science in interpreting behavior, and the divisions of behavior psychology and its relation to other sciences. In two articles Weiss (19, 20) points out the relations respectively between structural and behavior psychology and between functional and behavior psychology. First, without attempting to ascertain whether or not behaviorism is psychology, he endeavors to show that "the problems of the structural psychologist may be studied from the behavioristic point of view in accordance with the methods employed in the natural sciences and with a greater degree of simplicity than is possible from the structuralistic point of view." Since science recognizes only conscious states that express themselves in behavior of some form, this behavior alone calls for analysis. Again, since introspection is behavior (speech) and since introspection usually reveals only reactions to obscure stimuli, it is better to direct our study at once to behavior and especially to the major reactions, for these are the important objects to be investigated. Finally, behaviorism can analyze as far as structuralism, can present its phenomena as a causal series, and, if it succeeds in solving its problems, can solve all the problems of the structuralist also. Second, "the functionalists have never shown how mental activity may control action." On the contrary, the evidence shows that "conscious processes" follow and do not cause the conditions that modify behavior. Moreover, here as in structural psychology, verbal reactions have little if any influence upon the socially significant reactions.

In contrast with the foregoing Yerkes (21) finds Watson's dogmatic assertion of the adequacy of behaviorism and his refusal to admit the possible value of other presuppositions and methods "an 'illiberal attachment' to an assemblage of ideas which is in itself valuable, but which certainly does not monopolize the profitable possibilities of psychology or physiology."

Related to Watson's behaviorism is his hope (16) that "the men behind the psychoanalytic movement will come to realize that they have not built up a complete psychology differing *toto caelo* from anything which has existed before. When clearer discussion is possible we venture to predict that the one thing which will stand out as distinctly Freudian will be their utilization of the principle of *Uebertragung*." That is to say, by the method of conditioned reflexes emotional reactions can be bonded with new situations and these emotional reactions furnish the 'drive' absent in ordinary behavior. To an earlier and similar criticism of the Freudian psychology made by Watson, Jelliffe (11) replies that the behaviorist misunderstands the terminology of the Freudian and the place it occupies in practical psychology. The Freudian is not using the effete terms of psychology, rather he has taken many of those which had grown meaningless and sterile and has put new meaning and life into them. At this point two criticisms of Holt's book, *The Freudian Wish*, may conveniently be referred to. Neither author finds Holt a genuine Freudian. According to Watson (18) he is a behaviorist, but not a thoroughly consistent one. According to Calkins (3) he makes the self psychologically fundamental without having intended to do so.

Finally, three other articles should be mentioned here because of their explicit or implicit criticism of extreme behaviorism. Pillsbury (12) in discussing the new developments in psychology during the past twenty-five years refers to three types of psychological explanation at present apparent, at one extreme animism and at the other behaviorism and between these extremes the explanation of mental states in terms of other mental states. This last is adopted by the majority of psychologists. His own view is that "the choice of one rather than another of these general principles of explanation seems so little related either to the known facts or to the earlier experience of the psychologist that it can hardly be regarded as other than arbitrary." Against the attack of behaviorism upon introspection as a method of psychological research Washburn (15) raises three points. First, it is not because introspection has produced no results of scientific value that it is attacked by the behaviorist but because

he is not interested in states of consciousness and therefore thinks an account of them worthless. Second, introspection has been of extreme importance as a supplement to objective methods, for example, in the study of the learning process and even in abnormal psychology. Third, where, as in the study of the higher thought processes, no objective methods are available, the unsatisfactory condition of affairs is our own fault. "Why should we not recognize that conflicting descriptions of the same experience, on the part of trained introspectors, are each of equal value and authority, and simply mean that the experience in question really differs in different minds?" Carr (5) proposes the view that "the mental functions with which psychology concerns itself are in reality psychophysical, and at times neural, activities and that psychology shall study and attempt to comprehend these functions in their entirety." This view offers a way to mediate between the extremes of subjectivism and behaviorism; it changes our attitude toward the purposes and methods of comparative psychology; and it removes the serious difficulties of subjectivism.

At the December 1916 meeting of the American Philosophical Association the nature of the mental as contrasted with the physical was an assigned subject for papers and discussion. Fite (9) puts the question, Where in the world is consciousness? He replies, Where in the world is it not? It is not in the mind but in the world and everywhere in the world. It is the "familiarity" and "intelligibility" of things as opposed to their "strangeness" and "opacity." "In the familiarity and intelligibility of things we find our consciousness and ourselves; in their strangeness and opacity, the limitations of our consciousness and of ourselves." Again, "in the familiarity and intelligibility of things I find myself; but I am myself no less substantive an entity, and no less of an immediate and original fact or phenomenon, than the things with which I am familiar." Bode (1) maintains that the problem of consciousness must be attacked through a consideration of the facts of behavior. But not all behavior is conscious behavior, and therefore in differentiating conscious from other behavior we find the nature of the mental or psychical. "All consciousness is behavior directed or controlled by the environment with reference to a future result or a future adaptation." It is not specific response as such (Holt) but is an organized system of discharge. And this organization is not an inborn mechanism as is reflex action, but is experimental, flexible, and selective, and must be provided for continuously. Cohen (8) finds in a neutral monism

(or it may be equally well called a neutral pluralism) the basis for distinguishing the mental and the physical. "Every system, physical or mental, is but a class or selection of neutral entities, and therefore can be defined only by the character of the fundamental principles or postulates of the system." The physical is the class of entities to which physical laws are applicable and the mental the class of entities to which in turn psychological laws are applicable. And the two classes are not mutually exclusive. Pratt (13) defends a dualistic view. "Consciousness and the world of physical objects in space are essentially different from each other in kind." The psychical though spatial is not in space and exists only as functions of organisms. Some of the principal reasons for this dualism are: the subjectivity of emotions, meanings, images, and so forth; the privacy of the mental content; the innumerable different images derivable from one physical object by different observers and by the same observer at different times; and the physical and physiological facts of perception. Hoernlé (10) maintains, on the one hand, "if we want definitions of the mental and the physical as distinguishable entities in our universe, we should go to the sciences which need and offer such definitions, and not to philosophy"; and, he maintains, on the other hand, philosophy should point out that the objects of science are ideal constructions, abstractions, or selections. The mental and the physical do not exhaust between them the whole universe. Finally, if we "restore both terms to their context in concrete experience, we perceive that their relation is not one of mutual exclusion, but rather that mind is a distinctive form of activity exhibited by bodies of a certain structure." Urban (14) deals with a related problem, the knowledge of other minds. To know one's own mind is to know one's purposes, intentions, and meanings; and to know another's mind is to share his meanings, intentions, and values.

The general standpoints presupposed in self-psychology have been further discussed by Calkins (2, 4). First, self-psychology is to be distinguished from vitalism. The two doctrines oppose in common a mechanistic conception of psychology, but there the agreement ends. "For the heart of vitalism is its metaphysical conception of a soul which guides the organism in its growth and functioning, whereas self-psychology deals with the experienced self to which it attributes neither freedom, nor a peculiar potency, nor guiding force." Second, why do not all psychologists acknowledge the existence of the self? There is an historical reason. The self has been confused with the soul, and modern thought has wrongly discarded

the former with the latter. The self should be reinstated; for the valid objections that hold against the soul do not hold against the self. But the soul must go as a concept in psychology.

Two further general standpoints of psychology have been discussed. Chase (6) defends the doctrine of inheritance of modifications of behavior. "Glandular responses such as those given in strongly emotional situations become easily comprehensible if they are viewed as conditioned reflexes which, once set up in ancestral organisms, were transmitted." This view is supported by the experiments of Kammerer and the 'hormone theory' of Cunningham. Moreover, it accounts for the fact that many sorts of ancestral experience are not inherited. The same author (7) argues that students of social problems should base their theories upon the laws of human behavior rather than upon the laws of biology and economics.

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CONSCIOUSNESS AND THE UNCONSCIOUS

BY A. P. WEISS

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The contributions, by professional psychologists in which the term consciousness and its derivatives are placed at the center of gravity are becoming fewer in number, and the references are of a supplementary character in which either a structural or analytic attitude is taken for granted. Those who regard consciousness from the functional standpoint, while maintaining the interaction between mental activity and bodily processes, do not emphasize this relationship, preferring rather to leave the mind-body problem subsidiary to the actual analysis and investigation of human conduct.

Titchener (10) gives an excellent genetic analysis of the Wundtian concepts of consciousness and attention and also answers the objections raised by Britz (1) against the concept that sensory clearness is the elementary phenomenon in what is ordinarily called attention. A clear and concise exposition of the nature of cognitive and attributive clearness is incorporated in the discussion and gives the article its prime merit. Carr (2) suggests that more emphasis be given to the psychophysical and neural conditions in mental process. In teaching psychology much unnecessary confusion results because the exclusively subjective descriptions of traditional psychology are given independently of the neural basis. A complete description of mental phenomena should include both the psychical and physical aspects as a unified system. By a revision of the definitions in psychology so they will conform to the actual methods which already prevail we can do much toward the elimination of the sharp distinctions which confuse rather than enlighten students.

The need for definitely formulating the relation between the con-

scious and the subconscious when interpreting or requiring introspective reports is indicated in a discussion by Martin (4) who believes that our opinion of the value of some introspective data depends upon our view of the relation between the conscious and the subconscious, in fact, of the subconscious itself. What may be termed a borderline case between waking and dream consciousness is experimentally investigated by Yoakum and Hill (12) in the case of Miss Z., in which groups of twelve consonants that were to be memorized were reproduced by free associations which formed the outline of a story. The peculiarity of these stories lies in their resemblance to dreams, having the same sort of symbolism, wish-fulfillment and expression of 'repressed complexes.'

The conservatism in the use of the term consciousness characteristic of the professional psychologist is not shared by the psychoanalysts who crowd man with a host of the spirits of departed and not always noteworthy ancestors to intrude themselves into all that is bad and the little good that is left. This school would do well to realize that to say a 'subconscious process elaborates an idea to escape the censor' is merely a fanciful way of indicating that the consciousness of a normal person is different than that of the abnormal. Neurologists have failed to find a 'censor,' the 'libido,' the 'psychic energy' and the host of other entities that are introduced. It is simpler and far more scientific to merely state the facts. Such statements as 'the unconscious succeeds in breaking through without the necessity for a direct attack upon the barriers of the censor, which are rather circumvented in a clever manner,' belong to the realm of poetry or mythology; not to science.

The biological concept of recapitulation in the embryological development of the individual is applied to psychopathic conditions by Jelliffe (3) who believes that in a limited sense we may regard the psychic development of the individual as a recapitulation of the psychic evolution of mankind, which however is much obscured by the variable nature of verbal forms of expression. An interesting technique (psychogram) for recording the psychopathic conditions of a patient is also developed. Following along the lines laid down by Rousseau, Ring (8) defines psychoanalysis as a method for discovering in the mind forgotten experiences, the emotional tone of which is still active and is the determining cause of physical or mental conditions. Parsons (5) raises the question whether the gradual disappearance of the belief in evil spirits in modern culture may not be due to the general weakening of the instinct and emotion of fear.

Reminiscent of vitalism and faculty psychology is the article by Rank and Sachs (6) in which every affect, and the idea invested by it, has a natural tendency to appropriate as great a part of the mental life as possible as a consequence of affective forces. A comprehensive attempt is made to show the significance of the myth and legend for revealing the nature of some of those mental mechanisms which clamor for expression, but are never permitted to express themselves in their primary form. When the same sort of interpretation is extended to the social sciences (7) we find that a psychoanalytic examination of the fundamental concepts underlying the social sciences reveals a definite phylogenetic series from old mental attitudes which have been abandoned as unsuitable, to the modern conceptions which represent the most refined methods by which the originator was able to circumvent the censor.

Among the psychoanalysts who feel the need for restraint in the multiplication of entities are Solomon (9) who believes that the analytic methodology and the dynamic view-point of mental mechanisms as developed by the Freudians has done much to bring system and order into mental science, but cautions against the tendency toward loose and unclear terminology, the overemphasis of psychical determinants and the exaggerated importance given to infantile and early childhood tendencies. Psychobioanalysis is suggested as a suitable name for the broader conception of psychoanalysis which is supplemented by an analytic study along evolutionary and developmental lines, of the instincts, mental and moral qualities, tendencies and general makeup of man. In referring to the symbolic form in which consciousness often appears, White (11) concludes that what in consciousness would be regarded as anti-social and unconventional, may express itself in symbolic form and thus effectively disguise from the subject a consciousness that otherwise would be painful.

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DREAMS

BY ELLIOTT PARK FROST

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The dream theories of Bergson, Freud and Maeder, previously reviewed, are still being discussed by several writers. Bergson's belief that the dreamer possesses a relaxed consciousness is denied by Horton (10); and the more vigorous rôle ascribed to consciousness by Freudian theories, is upheld: irrelevancy in dreams is not due, as Bergson would have us believe, to lack of sufficient energy on the dreamer's part to summon the correct image, but rather to the fact the dreamer is pre-stimulated and over-prepared in the direction of the irrelevant response. Marshall (13) agrees with Bergson that the nature of our dreams is clearly statable in that part of consciousness of which we are aware, and involves no subtle mystery such as Freud would weave about it; dismissing Freud with the remark that while the practical value of Freud's work in relation to Hysteria and kindred problems may long be remembered "his theory of dreams will soon be laid aside as untenable and forgotten."

Crenshaw (3) cites six dreams to substantiate his thesis that retaliation or revenge-motive dreams are as important if not as frequent as sex-motive dreams. Horton (11) also criticizes Freud in that he fails to reveal the inner nature of dreams other than those with sex phantasy at work, and in that he fails to give the *modus operandi* of dreaming as a process of thinking. He contrasts the "reductive methods" of Freud and the "constructive methods" of Jung, with his own "reconstitutive method." This method aims "to 'reconstitute' the dream-thought . . . by tracing the wave of nervous excitation from its origin in primary stimulus-ideas . . . through a

specific apperception-mass into a consequently derived system of secondary images which form the manifest dream content." For instance, such a stimulus-idea as might be caused by the actual scratching of a mouse in the sleeper's room, constitutes a problem which the dreamer, by a process of trial and error, attempts to resolve and interpret; the dream is the result. This would agree with Marshall (13): "In what we call our dreams we catch for the moment . . . certain mental items that were relatively emphatic in the psychic field during sleep, before the threshold was raised."

Savage (16) believes that a study of dreams may assist in diagnosis in many cases of mental disturbance; that erotic dreams may give rise to false charges of assault in neurotic persons; and that "happy dreams" in cases of chronic melancholia are indicative of a favorable prognosis. Jelliffe (12) scores the spirit of levity in one of Maeder's critics and in general defends the right to be heard, of the Freudians, implying that many of their harshest opponents are but exhibiting a defense reaction—an *ad hominem* argument difficult of refutation (cf. 18).

Several writers bring us fresh material and new opinions on the dream problem. Y. Delage promises us a book on the subject and several chapters appear in various periodicals (*e. g.*, 4, 5, 6). Perhaps the most stimulating of these original treatments are those of Horton (9) and of Gregory (8). Oneiric (*i. e.*, "dream-") conversion, says Horton, is produced by residuary facilitations in prepared neurograms (using Prince's term); that is to say, an actual stimulus from the outside world, *e. g.*, a *door-slam*, becomes in the dream a different stimulus-idea, *e. g.*, a *shot-fired*, and engenders a rapid train of corollary ideas, such as 'battle,' 'marching,' and the like; because for some reason (explained by the previous experience, dream or real, of the sleeper), the "shot-fired" association finds neurograms already mobilized, and the irrelevant "door-slam"-idea does not. Therefore the latter, though actually the prior stimulus, succeeds in crossing the threshold of awareness, if at all, only after the better facilitated "shot-fired" association has done so. There is therefore an apparent time inversion: the "shot-fired" dream appears to precede the "door-slam" consciousness, which latter may actually, however, arouse the sleeper.

Gregory (8) is also interested in the time-aspects of the dreaming state. He agrees with Seashore (17) that a dream may pass like a flash, and appear to last for hours, or days—a statement so often made that it is almost a platitude, yet one whose facts supporting, have

never, to the reviewer, appeared convincing. Gregory further explains "the disturbance of the time-sense in dreaming" as due "to the expanding effect of a sudden or explosive rise of interest" on the part of the dreamer. He believes it an error to regard dreams produced by a disturbance that awakes us, as occurring during sleep: "they occur explosively during the momentary period in which the mind springs from unconsciousness to its waking realization of the world." As the mind breaks away from the unconsciousness of sleep and "springs forward in a sort of psychical explosion, some sensations may obtrude themselves and a hurried context is supplied to them from memory"; and context and sensations fuse to produce the dream.

Much more original work remains still to be done in investigation of the temporal aspects of dreams. Curiously enough material is, if anything, over-abundant. Anyone who has made a serious effort to study his own dreams will sympathize with Seashore who confesses he has "found it advisable to abandon the intensive study of dreams" in the interests of sleep. Perhaps it explains, too, the same author's conclusion: "there is perhaps no dreamless sleep"!

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TERMINOLOGY

BY HOWARD C. WARREN

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Dunlap (1) sought the opinion of 125 American psychologists, selected for seniority in years of service, in regard to the use of the terms *experience*, *consciousness*, *content of consciousness*, *thought*, *sensation*, *sense datum*, and certain cognates. The results, according to the author, reflect the confusion which exists at present concerning the fundamental concepts of psychology, but indicates a favorable outlook for improvement. "The term *experience* seems hopeless of standardization." *Consciousness* has lost some of its earlier meanings; there appears a tendency to limit it to *awareness* or cognition. He finds also a tendency "to use the terms *thought* and *sensation* for forms of awareness" (53). *Sense datum* is favored as denoting the object of awareness. (This investigation led to the appointment of a committee on terminology by the American Psychological Association, whose report is forthcoming.)

Pillsbury (4) defends the use of the term *behavior* to describe the object of psychology in the broadest sense. He insists that our fundamental definition should be "the servant of our science, not its master." It should "state the aims of the science in the briefest form possible, and in terms that shall be best understood by the individuals for whom it is intended, that shall be least open to misunderstanding" (372). In contrast with the more subjective terms, *behavior* includes processes of our active life—habit, instinct, learning, etc.—which have little or no relation to consciousness. His plea is for an enlargement of the connotation of the term *behavior*, rather than a limitation of the field of the science.

Tawney (5) on the other hand considers *behavior* too broad and ambiguous a term to use in characterizing the subject-matter of psychology, since it may denote such varied activities as "the action of oxygen or the motion of a comet" (29). Even *intelligent behavior* is too vague, for "in what sense can the behavior of lower organisms be said to display intelligence?" (29). "The fundamental fact of

mental life is the fact of value, the tendency of psychic organisms first to select and then keep within their control whatever is necessary to their life" (31). For this type of behavior he proposes the term *acsimation*. The discussion illustrates the chasm between voluntaristic and comparative psychology.

Two contributions from neighboring fields may be noted. Fuller (2) in proposing a revision of nomenclature protests against the use of proper names in brain and cord anatomy (*e. g.*, Rolando, Gowers, Goll, Clarke) on psychological grounds. Such names involve abstract memory; they bear no reference to the location or functions of parts, and are needlessly difficult to learn and retain. (The names of diseases—Pott's, Bright's, etc.—present similar difficulties.) Psychology is comparatively free from this evil, but a few instances, such as Purkinje phenomenon and organ of Corti, will come to mind.

Osborn (3) following Gregory distinguishes between *heritage* and *habitus*, the former denoting the totality of inherited or "palaeotelic" characters, the latter the totality of recent adaptive or "caenotelic" characters. (We should not confuse the *habitus* with *habits*, *i. e.*, individually acquired characters.)

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TEXT-BOOKS AND GENERAL TREATISES

BY HERBERT SIDNEY LANGFELD

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The only new text-book of general psychology this year is that of Breese (11). It is a book of the conventional type, clearly written and systematic. The author does not attempt to give new theories nor to make any important changes in the traditional psychological doctrines. There are, however, two distinctive features. Different views are presented upon controversial points, and the reader is thus

given a very comprehensive view of the subject. This makes the book useful to advanced students as well as to beginners. Secondly, the author has not treated his subject from one point of view, but under each topic has given relevant introspective data from structural psychology and the facts derived from functional, genetic and physiological psychology. He has held to this method so consistently that in some instances he is forced to offer very hypothetical descriptions. It must be added, however, that the reader is made clearly aware of that which is mere speculation. One notices the influence of James and Titchener. After a short introduction setting forth the scope and methods of psychology and the nature of consciousness and mind, there follows a description of the nervous system with illustrations, which throughout the book are well chosen and excellently reproduced. Between this and sensation is a chapter upon attention. The general facts of sensation such as their classification, after-effects, adaptation, *etc.*, precede a detailed description of the individual senses beginning with the lower senses. Under perception are found recognition and meaning, illusions, hallucination, and space and time. Memory begins with a description of the image. The three stages in the memory act, retention, recall and recognition, are explained as well as the methods of memorizing. Since mental images of past experience are necessary for memory, it is evident that memory and imagination overlap. The latter subject, therefore, logically follows. Separate chapters are devoted to conception, judgment and reasoning. There is a psychological description of the nature and genetic development of the concept. The distinction is made between the concept produced by unreflective thinking, which is termed the psychological concept, and that which follows strict logical thought, called scientific concept. The various theories of the nature of judgment are reviewed and the forms of judgments described. The process of thinking is given according to Dewey. The imageless thought problem is also described. After chapters upon affection and the emotions there is one upon "Consciousness and Behavior," in which one finds descriptions of reflexes, habit, an analysis of the volitional act and the learning process and a statement of the law of dynamogenesis. In the chapter upon the will there is a discussion of the possibility of the *fiat*, with reference to authors for and against this concept. The normal and abnormal experiences of the self are contained in the last chapter.

The new edition of Judd's *Psychology* (5) is so thoroughly revised that it will be welcomed as an addition to the present list of useful

text-books. Two chapters have been added, but the new book is nevertheless somewhat shorter than the old, as almost all the chapters have been reduced in size by omitting controversial points and theories difficult of comprehension by beginners. There are changes in almost all the chapters and six of them have been almost entirely rewritten. The doctrines of functional psychology are further developed and the psychology of attitudes receives more emphasis. The order of the chapters and most of the headings have been changed. The first part which is concerned with the nervous system and sensations has been little altered. Greater emphasis has been placed upon a system of classification according to the nervous processes. Attention is called to the necessity of not leaving a classification to the "accidents of introspection." "Experience and Behavior" is a new chapter. Here we have explained the relations of the sensory factors to reaction. Interest, recognition and the selective character of consciousness in general are explained. The reader is told that introspection over-emphasizes the sensations. Attitudes are explained and attention is shown to be conditioned by organization and coordination of the individual's active processes. The chapter formerly called "Experience and Expression" is now "Certain Fundamental Attitudes." There is less about the esthetics of rhythm and harmony. "Sensations and their Functional Relations" is now "Combination and Arrangement of Sensations." In the chapter "Speech as a Form of Behavior" the place of gestures in the development of speech is mentioned and illustrations of the development of written symbols have been added. In "Memory and Ideas" the subjective character of ideas and reference to Galton are omitted and the part concerning the image has been cut. The author realizes that much that was written about judgment belongs to logic, so that the chapter "Imagination and the Formation of Concepts" has been shortened. On account of controversial points, the chapter on "The Idea of the Self" has been greatly reduced. In his preface the author states that the chapter on volition has had to be rewritten to make it in keeping with his view of the importance of consciousness in evolution. The treatment is more objective and less open to the criticism of faculty psychology. A chapter on "Mental Hygiene" is new. It offers useful suggestions for increased mental control.

Hollingsworth and Poffenberger (3) have written the first book that can be used as a general text in a course in applied psychology. The book may be divided into two parts. Somewhat more than half considers the results of modern behavior psychology which bear upon

the efficiency of the individual. The other part consists of the "attitude, content, and technique" of psychology in their practical aspects. The authors have presented a great many facts of use both to the individual and to the group, and have pointed the way for future development. There are descriptions and results of experiments bearing upon the points in question. Reference is frequently made to the researches of Thorndike, and of the authors and their pupils. A few experiments are given in some detail, but there is very little description of methods or technique. The book is essentially an introductory text and not a manual. The first point to be considered relative to individual efficiency is the influence of heredity. Mention is also made of the peculiarities of the various races. The inheritance of mental defects is discussed at some length, and the agitation in various states for control of marriage is described. There follows a chapter on the learning process and another on the influence of sex and age. Some of the results of mental tests to determine the differences between men and women are given. The difference between mental and physical age is described at some length. Several chapters are devoted to environmental condition. The effect of climate, seasons of the year, the weather, temperature, and humidity are most important when considering efficiency. The next chapter includes the physiology and psychology of fatigue and recuperation. A number of problems concerning the effect and amount of sleep is considered. A relatively large space is devoted to the value of various foods. In that part of the book devoted to the application of psychology to special fields, the first problem is that concerning the executive. There are here included the results of tests for vocational selection, and mention of the work of Gilbreth and Taylor in scientific management. In the next chapter the psychology of the worker himself is described. A chapter on the "Psychology and the Market" deals with the psychology of emblems, trademarks, with experiments upon trademark infringement, and with advertising and salesmanship. Under "Law" one finds the free association method, the influence of suggestion upon testimony with illustrations from Muscio's investigation, and the usefulness of psychology in juvenile courts. The chapter concerned with social work lays special emphasis upon delinquency and deficiency. Under "Psychology and Medicine" tests for motor and mental behavior are mentioned. In discussing the effects of drugs, attention is especially directed to controlled groups and controlled doses. In dealing with the educational problem the importance of analyzing the various processes involved in learning the numerous school subjects is explained.

Gordon's *Educational Psychology* (2), besides being a text-book for introductory courses in education, presents in condensed form useful information and helpful suggestions both to parents and teachers. Although the author states that an elementary knowledge of psychology is presupposed, the facts are stated so clearly and with such an avoidance of technical language that little preparation is necessary. The first part of the book is concerned with growth. There is a description of physical growth, of seasonal variation in development, and the relation of physical to mental growth. The various instincts including sleep, dreams, fear and play are discussed in so far as they are related to pedagogy. A description of the motor activities is concerned principally with motor control. Data concerning the sensitivity of the various senses are given under "Sensory Capacities." The learning process is analyzed with special reference to the methods of the learning curve and the rôle of pleasure and pain. In the chapter upon imagination much space is devoted to the function of the image and the various types. A short chapter deals with the reliability of children's observations and reports, and a chapter on memory, beside presenting the fundamental facts, offers some original data from experiments which show the importance of learning by context. Three chapters are devoted to the various processes involved in thinking. An original method of teaching syllogisms by means of colored circles is described. The nature of the transfer of practice is the subject of the next chapter which is followed by useful information concerning the attention and the control of feelings. The last three chapters take up the practical problems of teaching language, drawing and arithmetic. There are curves, tables and illustrations throughout the book.

The main change in the new edition of Starch's book, *Experiments in Educational Psychology* (10), is the addition of three short chapters. In the chapter upon individual differences a method is described of obtaining the speed in reading a prose selection, the degree of comprehension and the extent of the vocabulary of the individual. In another chapter a method is explained for ascertaining the distribution of marks given by the teacher to the class, and of determining how the various teachers differ from each other and from the normal distribution curve in this regard. A third chapter explains the use of the correlation formula.

Three volumes have appeared of the series entitled "Our Senses and What They Mean to Us," edited by G. V. N. Dearborn. Although they will probably not be used as text-books, the teacher may

consider using them as collateral reading in an elementary course, and for that reason they are included in this summary. The editor, however, desires them primarily to appeal to the layman. Being written by different authors, we must expect them to vary in value and treatment. The longest and the most inclusive of the three, (equal to about 100 pages of the BULLETIN), is *The Sense of Taste* by H. L. Hollingworth and A. T. Poffenberger (4). The subject is introduced by a description of the qualities of taste and its relation to smell and the important experimental facts. Several chapters are devoted to the anatomy and physiology of the sense. The part that taste plays in imagination and hallucination and the abnormalities of taste are touched upon. There is a short account of the biological significance of the sense and a comparatively long chapter upon its relation to esthetic experience. This last chapter is especially concerned with an explanation of the insignificant rôle that the lower senses play in the field of art.

The Sense of Sight is by F. N. Spindler (9). The book is very popularly written, and the facts are explained by numerous examples which will appeal to the general reader. The larger part of the book is concerned with the conventional topics. In the chapter upon the visual type, the author describes some original experiments. In the part on the emotions in relation to vision, the author ascribes the pleasantness to inherited and associative factors of a biological character. He describes at some length the necessity and means of developing visual perception in the child, and finally, he cautions us in regard to the care of the eye.

The subject of H. T. Moore's book, *The Sense of Pain and Pleasure* (6), offers the greatest opportunity for original treatment. In the preface he states that he has placed unpleasantness under pain and tickling under pleasantness, although he is aware that there is much to be said against such a classification. He begins by a description of the three types of pain: surface pain, bodily distress and unpleasantness. The three types of pleasure are tickling, gratification and pleasantness. He then sketches the genetic development of these sensations. In the chapter upon the meaning of these sensations it is stated that pain indicates a too great demand by the environment upon the organism and pleasure the presence of a conflict to which the organism is equal. The chapter upon the effect of pleasure and pain upon the organism leads to a description of the physiological mechanism underlying these sensations, and to the "Diagnostic Value of Pain." A few pages are devoted to "Æsthetic Pleasure,"

and there follows a brief description of play. The last chapter points out that the pursuit of pleasure must not be a direct one. The value of the book is increased by a good summary at the end of each chapter.

Wells's book, *Mental Adjustments* (12), which is one of "The Conduct of Mind Series," should be briefly reviewed here on account of the broad sketch it presents of the mechanism of the human mind, although it will probably also be found with the books upon mental hygiene. It shows a pleasing style and has that individuality so happily possessed by the author. It is replete with interesting facts and acute observations which will stimulate even those who may disagree with some of the contents. The adjustments are concerned chiefly with the fundamental sexual life of the individual, and with the relation of this instinct to the other activities of the organism. The opening chapter upon "Mental Adaptation" with its comments upon imagination and day dreams, and upon education is an introduction to what is to follow. In "Use and Waste in Thought and Action" the author makes clear with numerous examples the difference between autistic and realistic thinking and the place of each in the mental life. In "Symbolic Association" is shown the resemblance between symbols which have entered ordinary language, especially through the influence of tabus and the symbolism of dreams. In "The Continuity of Emotions" is described the transfer of emotions in normal and abnormal conditions which give rise to affective symbolism. In "Types of Dissociation" are included a wide range of such phenomena from the purely organic ones of paralysis of the lense and hemiplegia to the functional disturbances of multiple personality. The mechanism of dissociation is explained by the conflict of trends or moods. There is a concise account of the numerous methods of testing intelligence and character. The final chapter is upon the "Balancing Factors." Here are described the sexual, social and economic factors and their proper adjustment, with special attention to the marital relation and education.

Stratton's translation of Theophrastus (11) begins with a brief exposition of Theophrastus's *De Sensibus* including an evaluation of his writing, a description of his doctrine and methods of exposition and criticism and short chapters upon the topics treated: *e. g.*, vision, hearing, smell, taste, touch, pleasure and pain. There then follows the Greek text and an English translation on opposite pages and finally extensive notes upon the translation and text. The book is valuable for an historical course.

Although Parker's book, *The Self and Nature* (7), is primarily a

philosophical metaphysical treatise, it contains chapters which will be of some interest to psychologists concerned with the fundamental hypotheses of their science.* The author commences with a discussion of the nature and unity of the self. "The activities are interwoven among themselves and with the content, and this woven web is the mind." The author believes in personal identity, an identity which may be more or less, but which has reality in spite of the discontinuity of consciousness. Perception, time, space, and causality are treated metaphysically. In discussing the problem of the relation of mind and body the author criticises the theory of the instrumentalists, that the body is a tool of the mind. He believes that the functional character of images proves that mind is dependent upon the body.

Restrepo-Herandes' *Anthropologia* (8) is in most respects a psychological treatise. The author's object seems to be to reconcile modern theories with scholastic doctrines. It may be of interest to students of the history of psychology.

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NOTES AND NEWS

THE laboratory of psychology at Mount Holyoke College was burned December 20, with the loss of much apparatus and books. The director of the laboratory, Professor Samuel P. Hayes, would be very glad to receive for the use of the laboratory books and reprints of articles bearing upon psychology which may be offered.

THE following items have been taken from the press:

DR. EDGAR A. DOLL, who has been assistant psychologist in the Training School at Vineland, N. J., has been appointed an instructor in psychology at Princeton, N. J.

DR. GEORGE R. WELLS, associate professor of psychology in Oberlin College, has been appointed professor of psychology and head of the department at Ohio Wesleyan University.

PROFESSOR M. E. HAGGERTY, of the college of education of the University of Minnesota, has received a commission as major and has gone to Washington to take up his duties in the psychological division of the army.

DR. FRANCIS N. MAXFIELD, who has been assistant professor of psychology and assistant director of the psychological clinic at the University of Pennsylvania, leaves the university on February 1 to become psychologist in the Public School Clinic of Newark, New Jersey.

WE regret to see the announcement of the death, of the veteran alienist, Dr. Henry Maudsley, for many years editor of the *Journal of Mental Science*. His *Responsibility in Mental Disease* appeared in 1874, and was first of many works such as *Physiology of Mind*, *Pathology of Mind*, and *Body and Will*.

THE PSYCHOLOGICAL BULLETIN

PROCEEDINGS OF THE TWENTY-SIXTH ANNUAL MEETING OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION, PITTSBURGH, DECEMBER 27, 28, 29, 1917

REPORT OF THE SECRETARY, H. S. LANGFELD, HARVARD UNIVERSITY

The twenty-sixth annual meeting of the American Psychological Association was held in affiliation with the American Association for the Advancement of Science at the Carnegie Institute of Technology on Thursday, Friday, and Saturday, December 27, 28, and 29, 1917. Owing to the activities of many of the members in war work, the program was shorter than usual, but the thirty-one papers offered sufficient material for a very profitable meeting. Four papers were of a general nature, nine were upon topics of experimental psychology, ten upon mental tests, five in educational psychology, two in abnormal psychology, and one upon the work of the Committee on the Classification of the Personnel in the Army. All but one of the sessions were held at the School of Applied Design of the Carnegie Institute.

The Thursday afternoon session and the business meeting following it were held in Psychology Hall of the University of Pittsburgh, and the members were given the opportunity at that time of inspecting the laboratories of that institution.

On Friday morning there was a joint session with Section H of the American Association for the Advancement of Science. Instead of having a parallel session on mental tests, the papers of this session were distributed throughout the other sessions. On Saturday morning there was a joint session with Section L of the American Association for the Advancement of Science. There was considerable discussion at this session, in marked contrast to the previous session, and the hope was expressed by many members that in

future meetings there would be an increase in the criticism and discussion. Considering the number of members who are in the service of the government and therefore could not be present, and the difficulties of transportation, the attendance was a large one. There were about a hundred members at the meeting, besides a number of visitors.

The apparatus exhibit was held in a room in the School of Applied Design near the lecture room and was an important feature of the meeting. Beside an exhibition by C. H. Stoelting Company of Chicago, there were the following new apparatus presented by members of the Association: A Pneumograph and A Short Exposure Apparatus, by C. T. Gray, University of Texas; A New Model Electro-Magnetic Stimulus Shuffler, and A New Control Machine for Continuous Choice Reactions, by L. T. Troland, Harvard University; A Seconds Pendulum and Interval Timer, by A. P. Weiss, Ohio State University; A New Acoumeter, A New Form of the Steadiness Tester, and Tactual Discrimination Cards, by Knight Dunlap, Johns Hopkins University; Models of Motion Studies, by F. S. Gilbreth, Providence, R. I.; Fifty Small Colored Pictures of Oriental Rugs for Esthetic Judgments, by K. Gordon, Carnegie Institute of Technology, a new form of the Self-Registering Tapping-Board by the Harvard Laboratory; a new form of the Pictorial Completion Test by W. Healy, Juvenile Court, Boston.

The annual dinner was held at the Pittsburgh Athletic Association. There were ninety present, including members and guests, and before the smoker the President, Major Yerkes, delivered an address upon Psychology in Relation to the War. He held the rapt attention of his audience for almost two hours in describing the historical development and work of the various psychological committees of the National Research Council.

The perfection in the arrangement of the various sessions was due to the untiring effort of Mr. J. B. Miner, the local member of the executive committee.

TRANSACTIONS AT THE ANNUAL BUSINESS MEETING

The annual business meeting was held at 4 p. m. on December 28 in Psychology Hall of the University of Pittsburgh. It was voted that the minutes of the previous meeting be accepted as printed.

The President then called for the reports of committees.

The secretary for Mr. Dodge, chairman of the Committee on

Election of Officers, reported the results of the ballot of the Association to be as follows: for President, Mr. John Wallace Baird, of Clark University; for members of the Council elected for three years in succession to Messrs. Angier and Scott, Messrs. Dearborn and Ogden. The report was accepted.

Mr. Yerkes reported that on account of the war the Committee on Standardization of Mental Measurements and Tests had made no progress. It was voted that this committee be continued.

Mr. Thorndike for the Committee on Teaching Experiments stated that there was no new work to report. It was voted that this committee be continued.

Mr. Baldwin reported that the war had also prevented any progress of the Committee on the Academic Status of Psychology. It was voted to continue this committee.

Mr. Warren reported the work accomplished by the Committee on Terminology and submitted mimeographed sheets and proof drafts of the results of its investigation. It was voted to accept the report, to continue the committee and to authorize the withdrawal of \$50 from the principal funds of the Association to defray the expenses of this committee for the following year.

The following items of business reported by the Council were then acted upon:

I. It was moved that the time and place of the next annual meeting be left to the Council with power. Mr. Buchner proposed an amendment that, if feasible, the meeting be conducted in conjunction with the American Association for the Advancement of Science. The motion as amended was carried.

II. It was voted to leave to the Council the appointment of a member of the council of the American Association for the Advancement of Science for 1918.

III. The secretary reported the deaths of the following members of the Association during the past year: Brother Chrysostom, January 23, 1917, aged 54; John Edward Russell, February 26, 1917, aged 70; Charles Hughes Johnston, September 4, 1917, aged 39.

IV. The Treasurer's report as printed below was read and accepted. The following budget prepared by the Council was also read and adopted.

ESTIMATE OF RESOURCES

On deposit.....	\$ 67.00	
Dues.....	325.00	
Interest.....	90.00	
Sale of monographs.....	?	
Withdrawal from principal funds.....	<u>400.00</u>	\$882.00

ESTIMATE OF EXPENDITURES

Printing and supplies.....	\$275.00	
Postage.....	125.00	
Reprints.....	75.00	
Abstracts.....	50.00	
Incidentals of meeting.....	25.00	
Apparatus exhibit.....	25.00	
Election committee.....	50.00	
Secretary's stipend.....	250.00	
Other committees.....	?	\$875.00

Mr. Buchner moved to authorize the secretary to withdraw the \$400 from the principal funds of the Association. The motion was carried.

V. It was voted to authorize the secretary to withdraw from the principal funds of the Association the sum of \$391.05 to defray the war expenses incurred by the President from April 10 to August 14, 1917.

VI. It was voted to reimburse the Council for their expenses incurred at the special council meeting in Philadelphia in April, and to authorize the secretary to withdraw the amount from the principal fund of the Association.

VII. It was moved that an amendment to the Constitution be made, increasing the annual dues from \$1 to \$2. Mr. Buchner moved that the motion be laid on the table. The motion was lost. Mr. Warren moved an amendment to increase the annual dues from \$1 to \$2.50. The amendment was lost. The original motion was then carried.

VIII. The secretary reported the following nominations to membership in the Association and was instructed to cast the ballot of the Association for their election: John E. Anderson, Ph.D., instructor in psychology, Yale University; William Howard Batson, Ph.D., head of the department of education and director of the training school, Southwestern State Normal, Weatherford, Oklahoma; Ethel Bowman, Ph.D., assistant professor of psychology, Goucher College, Baltimore, Md.; Clarence G. Bradford, Ph.D., professor of psychology, Ada, Oklahoma; Ivey Gertrude Campbell, Ph.D., associate professor of psychology, Wells College, Aurora, N. Y.; Helen Clark, Ph.D., instructor in psychology, Vassar College, Poughkeepsie, N. Y.; Harold Randolph Crosland, Ph.D., assistant professor of psychology, University of Arkansas, Fayetteville, Ark.; John Frederick Dashiell, Ph.D., instructor in psychology, Oberlin College, Oberlin, Ohio; Arthur Irving Gates, Ph.D., lecturer in

educational psychology, Teachers College, Columbia University, New York City; Buford Jennette Johnson, Ph.D., assistant psychologist, laboratory of social hygiene, Bedford Hills, New York; Edward Safford Jones, Ph.D., assistant professor of psychology, Oberlin College; Harry Dexter Kitson, Ph.D., instructor in psychology, University of Chicago; Frances Lowell, M.A., research assistant, department of research, State School for Feeble-Minded, Faribault, Minn.; Bertha M. Luckey, Ph.D., director of psychological research, Cleveland public schools, Cleveland, Ohio; David I. Macht, M.D., lecturer in pharmacology and instructor in clinical medicine, Johns Hopkins Medical School; William A. McCall, Ph.D., instructor in educational psychology, Teachers College, Columbia University; Donald G. Paterson, instructor in psychology, University of Kansas, Lawrence, Kansas; Louis Augustus Peckstein, Ph.D., assistant professor of psychology and education, University of Rochester, Rochester, N. Y.; Sidney L. Pressey, Ph.D., instructor in psychology, Indiana University, Bloomington, Ind.; Prentice Reeves, A.M., research psychologist, Eastman Kodak Company; Gilbert Joseph Rich, Ph.D., instructor in psychology, Hobart College, Geneva, N. Y.; Sarah Margaret Ritter, Ph.D., instructor in psychology, City Normal School, Sioux City, Iowa; Abraham A. Roback, Ph.D., instructor in psychology, University of Pittsburgh; Anna Sophie Rogers, Ph.D., demonstrator in biology, Bryn Mawr College, Penn.; Beardsley Ruml, Ph.D., instructor in psychology, Carnegie Institute of Technology; George Samuel Snoddy, Ph.D., assistant professor of psychology, University of Utah, Salt Lake City; Aaron Moyer Snyder, Ph.D., assistant professor of psychology, University of Pittsburgh; Percy Ford Swindle, Ph.D., instructor in physiology, Tufts College Medical School, Boston; Robert Brown Teachout, Ph.D., assistant professor of psychology, University of Oregon, Eugene, Oregon; Lewis M. Terman, Ph.D., professor of education, Stanford University; Louis L. Thurstone, Ph.D., instructor in psychology, Carnegie Institute of Technology; Louis Winfield Webb, Ph.D., instructor in educational psychology, Northwestern University, Evanston, Ill.; Raymond Holder Wheeler, Ph.D., assistant professor of psychology, University of Oregon; Jesse Hayes White, Ph.D., professor of psychology, University of Pittsburgh.

IX. The membership of the program committee for the ensuing year was announced as follows: Messrs. Angier, Baird, and the secretary.

X. Mr. Hollingworth as a committee of one appointed by the President on the recommendation of the Council offered the following resolution: "That the American Psychological Association, at its annual meeting, held at Pittsburgh, December 27-29, 1917, hereby expresses its approval of the aims and purposes of Senate Bill 2403, now pending, relating to the provision for establishment and maintenance of model demonstration rural schools; and of House Bill 6490, now pending, relating to the promotion of plans for the elimination of adult illiteracy in the United States; and that the secretary of the Association be requested to forward copies of this resolution to the proper representative in each House of Congress; to the chairman of the Education Committee of the House of Representatives; and to the Senate Committee on Education and Labor." The resolution was adopted.

XI. It was moved and carried that a committee be appointed by the president to report at the next annual meeting concerning the qualifications for psychological examiners and other psychological experts.

XII. It was moved to authorize the president to appoint a permanent committee on publications of applied psychology whose duty shall be to survey the publications, to approve such as seem to them worthy of publication; to condemn those which seem unfit, and to authorize the said committee to publish their report in *Science*, *THE PSYCHOLOGICAL BULLETIN*, and in such other publications as they may select. There was a lengthy discussion in which Messrs. Buchner, Warren, Kelly, Baird, Rogers, and Strong took part. Mr. Wallin offered an amendment to the effect that the function of the committee should be to pass upon material absolutely clap-trap. The amendment was lost. Mr. Aiken moved an amendment to substitute for that part of the original motion which read "whose duty shall be to survey, etc." the following: "whose duty shall be to consider the general merits of publications in, or professing to be in the field of applied psychology, and to publish their findings." The motion was carried as amended.

Under the head of new business Mr. Odgen moved, that the American Psychological Association express by a rising vote to its hosts of the Carnegie Institute of Technology and of the University of Pittsburgh, its deep appreciation of the excellent arrangements made for this meeting, and its hearty thanks for all the favors and courtesies being shown to its members. The response was unanimous. The meeting then adjourned.

REPORT OF THE TREASURER FOR THE YEAR 1917

DR.

To Balance from the previous year.....	\$2,654.46	
Dues received from members.....	330.35	
Interest from July 1, 1916 to July 1, 1917.....	90.17	
Gift from member.....	30.00	
Sale of monographs No. 51 and No. 53, year ending December 31, 1916.....	23.82	\$3,128.80

CR.

By Printing and supplies.....	\$ 172.98	
Postage.....	71.85	
Express.....	1.72	
Telegrams.....	1.44	
Reprints of Proceedings.....	31.06	
Reprints of President's address.....	20.43	
Incidental expenses, 1916 meeting.....	50.00	
Printing of Abstracts, 1916 meeting.....	24.72	
Expenses Election committee, 1917.....	29.02	
Secretary's stipend.....	250.00	
Exchange on checks.....	.10	
Committee on Terminology.....	30.00	
Committee on Teaching Experiments.....	5.56	
Committee on the Academic Status of Psychology.....	70.00	
Binding two volumes of the Proceedings.....	3.00	\$761.88
Balance in Fifth Avenue Bank.....	67.98	
Balance in Union Dime Savings Bank.....	2,298.94	2,366.92
		<u>\$3,128.80</u>

H. S. LANGFELD,

Treasurer

Audited by the Council

CAMBRIDGE, MASSACHUSETTS,
December 22, 1917

TITLES AND ABSTRACTS OF PAPERS

PRESIDENTIAL ADDRESS

Psychology in Relation to the War. ROBERT MEARNES YERKES,
University of Minnesota.

GENERAL AND EXPERIMENTAL PSYCHOLOGY

The "Mnemometric Function" and the Memory-Methods. E. G.
BORING, Cornell University.

The similarity of the problems of the "measurement of sensation" and of the "measurement of memory" suggests that we may determine a "mnemometric function," comparable to the psychometric function, and find a measure of memory in an associative limen. The required "mnemometric function" can be found by the application of some method of partial mastery (right associates, retained members, promptings, *etc.*) and shows percentages of material learned as a function of some effective condition of association, *e. g.*, number of repetitions or number of syllables in a series.

We may expect this "mnemometric function" to be approximated by the *phi*-function of *gamma* (*a*) because it is analogous to the psychometric function for sensation, (*b*) because it is indicated by certain properties of the nervous system, and (*c*) because it is actually thus approximated in experimental results, when we assume that successive repetitions are progressively less effective for learning.

The determination of associative limens from "mnemometric functions" renders a comparison of results taken under various conditions (as well as a comparison of different methods of partial mastery) easy and accurate, since we have for comparison single values of known precision.

The probable form of the "mnemometric function" indicates that methods of complete mastery are, of all memory-methods, least reliable; that half-mastery is approximately the most reliable measure of memory; and that various percentile differences in methods of partial mastery are not usually comparable.

The determination of the "mnemometric function" depends

upon a knowledge of some effective condition of association, *e. g.*, the relative value of successive repetitions for learning. The solution of this latter problem, conversely, depends absolutely on the solution of the former. Hence a joint solution is necessary. Experimental data, obtained by Mr. H. D. Williams, show that the compound assumption that associative impression is proportional to the logarithm of the number of repetitions and that the "mnemonic function" is the *phi*-function of *gamma*, is a fairly accurate hypothesis. The problem of the associative value of different lengths of series must be solved in the same manner.

The Effect of Distraction upon Reaction. E. E. CASSEL and K. M. DALLENBACH.

The aim of the experiment was twofold: first, to discover the effect of distraction upon the simple sensory reaction; and secondly, to discover the cause of the differences in results previously obtained.

The Hipp chronoscope and its accessories were employed, and the usual method of reaction experiments was followed. Reaction was made to the sound of a Wundt hammer.

After three months of training, for the attainment of a high and steady level of practice, the distraction-series were undertaken. Three distractors, a metronome, a bell, and a tuning fork, were used in different temporal relations. The bell rang for 2.5 seconds, beginning 1 second before the reaction stimulus. The metronome beat during a series of ten reactions, but was silent during the subsequent report. The tuning fork sounded continuously during the writing of the reports as well as during the reactions. In every hour from 8 to 10 series were taken, two to four of which were normal, serving as a control. These occurred equally often in the 1, 2, 3, 4, etc., place. 100 series with distraction, and 20 to 40 series of control reactions, were obtained for every observer with every distractor.

The gross averages of the distraction and control series showed that the distractors were always effective in the direction of a lengthened reaction; that the bell, the intermittent distractor, was the most effective; and that the tuning fork, the continuous distractor, was the least effective. The daily averages were, however, equivocal. On some days the distractors seemed to inhibit, on other days to facilitate reaction. The introspective reports showed that these variations were closely paralleled by changes of attitude. Hence we may conclude that the effect of distraction is dependent upon the observer's attitude.

This analysis explains the apparent contradiction in our results; the neglect of the factor of attitude by other investigators explains the equivocal nature of the results upon the effect of distraction so far published.

Vasomotion as a Test of Will Power. G. V. N. DEARBORN, Sargent Normal School, Cambridge.

Through a comparative study of the brachial vasomotion of the series of idiots, imbeciles, morons, terminal dementes, people "unable to concentrate," average persons, persons of unusual will-power, etc., the proposition that peripheral vasomotion is a criterion of will-power was suggested, and then proven to be true. The writer's "continuous" blood-pressure method was employed. The numerous hemobarograms of the research (as well as the protocols) are exhibited as part of the paper.

Certain tests of mental concentration in various directions were given to the subjects and the varying concomitant arterial tensions measured. These members in variation were then interpreted in the light of collateral evidence as to the mental dynamism of the respective subjects.

It is suggested that this test, wholly new in nature as well as in technique, is one of practical use in psychological examining.

Incentive and the Curve of Mental Work. F. C. DOCKERAY, University of Kansas.

When a subject is instructed to work at his maximum both as regards speed and accuracy, there is a tendency to make adjustments according to the length of period. The result is that little or no fatigue is evidenced in mental work at the end of one or two hours. Ergographic studies in which the subject is to work for a definite period show somewhat similar results. In adding figures both speed and accuracy vary. In the present investigation speed was controlled and only accuracy could vary in the record. The subjects added series of ten digits, dictated at a regular rate, in fifty to ninety minutes. A definite period was allowed after each series for the subject's response. The results uniformly showed a decided decrease in accuracy beginning with the second or third ten-minute period in untrained subjects, and with the end of the first ten-minute period as the subject gained experience with the test. The score of the last ten-minute period in a ninety-minute record often went as low as fifteen per cent. of the first ten-minute

period. When the subjects set their own "maximum" rate no such decreases were noted, and there were some individual differences in the curve not noted in the former case. There was not a definite correlation between speed and accuracy on different days, though in any one period there was a strong tendency to an increase in errors with a decrease in speed.

A Study of Esthetic Judgment. K. GORDON, Carnegie Institute of Technology.

Fifty colored pictures of oriental rugs were used as material to be judged. These were divided into two sets of twenty-five each; and subjects were asked to arrange in order of beauty the twenty-five of series one, and then to do the same for series two. One hundred and one persons took part in the test, and a distribution curve of their choices was made for each rug. The correlations between the judgments of each individual and the average of these correlations is .42 for the first series, and .42 for the second. In no case was a significant negative correlation found. The correlation between the average arrangement of the first half of the judges and the second half of the judges is .82 for one series of rugs and .87 for the other. The correlation between the average arrangement of thirty men and thirty women is .86 for each series of rugs.

The Logic of Intermediate Steps. H. L. HOLLINGWORTH, Columbia University.

A familiar form of argument in the natural sciences, especially in biology, psychology and anthropology, is based upon the evidence afforded by the existence of intermediate stages between two conditions, types or processes whose nature or origin is in question. The existence of such intermediaries is commonly held to indicate that the two extremes are either identical in essence or structure, or at least that the one is a direct development of or evolution from the other. The final abandonment of this serial argument in biology is pointed out. Numerous instances will be given from psychological discussions, in which this argument on the basis of intermediaries is still relied on. Specific references will be to Clarke, Kropotkin, Exner, Helmholtz, Watt, Brentano, Stout and Titchener. Objections to the validity of the argument will be cited from Miller, Bergson, McDougall, Bateson, Meumann and Woodworth. The argument involves a common type of logical fallacy, that of "affirming the consequent." The inadequacy and fallacious

character of this argument has already disqualified it in biology, history and anthropology, and should also be recognized in the interpretations of human institutions and individual experience. "From the fact that we pass from one thing to another by degrees, it does not follow that the two things are of the same nature."

Kinæsthetic Sensory Processes in the White Rat. W. S. HUNTER, University of Kansas.

The present work makes chief use of the T-shaped discrimination box of my earlier work on auditory sensitivity. The method was to force the animal to turn to the right in one trial and be fed, and then to turn to the left in the next trial and be fed, etc. Or he might be trained to alternate by twos (llrllrll), being fed after each trial.

Seven rats tested on lrlrlr, 10 trials daily, learned the rhythm in from 10 to 180 trials,—where the criterion of learning was an average of 87.5 per cent. correct for four days and no day below 80 per cent. The interval between trials was 12 secs. There was practically no habit interference when the opposite order of presentation was used (rlrlrl).

Five rats were now tested on a double alternation (llrllrll), 10 and 12 trials daily for 600 trials without improvement in the reaction. The interval between trials was 12 secs. Five rats were trained on double alternation, 8 trials daily with no feeding or time interval between trials. Learning was not apparent after 500 trials.

A maze was constructed of 10 T-shaped boxes so arranged that the choices were llrllrll. One trial a day was given each of six rats. All learned it readily. They were then transferred to the above problem of double alternation in the single T-shaped box. The alley stops were shifted while the animal was running so that a continuous path in the form of a figure 8 was always before him. His problem was to run twice around one loop and then twice around the other until 10 runs had been made. This problem, which may be termed a temporal maze, was never learned. Such a temporal maze composed of turns lrlrlrlr was mastered by one rat. Controls were used which indicated that contact cues derived from the end-stops were necessary cues in all cases of the temporal maze.

Kinæsthetic processes occur in time and not in space save as they are accompanied by vision or touch. If the white rat were

chiefly dependent upon a mere succession of kinæsthetic processes in running a spatial (the ordinary) maze, he should succeed in a temporal one. This he can do only when the latter is very simple.

Interesting comparative data have been secured with humans on a similar pencil maze.

Facial Expression and Suggestibility. H. S. LANGFELD, Harvard University.

The aim of the investigation was threefold: to ascertain the degree of accuracy in judging facial expression, to determine the suggestibility of subjects in the interpretation of facial expression, and to devise tests both for skill in judging character from faces, and for suggestibility in this field.

The stimuli used were one hundred and five pictures selected from the atlas accompanying the book of Heinrich Rudolph entitled *Der Ausdruck der Gemütsbewegungen des Menschen*. They are sketches of faces of a talented artist expressing various emotions and attitudes. Extensive preliminary experiments were made upon six subjects to determine the best methods of approach, the value of the various pictures for the purpose, and the possibility of agreement among the subjects.

The pictures were then presented (by Miss G. Speir) to five new subjects for their judgment as to the expression. Either the correct title, or one differing radically from it was then presented. Each picture was presented twice in the semester, once succeeded by the correct title, and once by the incorrect title.

It was found that all subjects accepted at times the incorrect title even when they themselves had approximated and accepted the correct title of a picture which had been proven to be a good portrayal of the expression in question. When the subject had not approximated the correct title, the suggestibility was naturally greater. The accuracy of suggestibility varied considerably with the emotions expressed, and with the subjects. One subject who apparently had little visual imagery, was extremely inaccurate and highly suggestible.

From the data, it was possible to select a series of pictures to be used in the development of tests.

The Attributes of Sound. R. M. OGDEN, Cornell University.

Pitch is the predominance in a sound which varies from low to high. The discrimination of this attribute at the middle range of

audibility correlates with an arithmetical progression of vibrational frequencies. Volume is the massive effect of sound, and grows progressively less from low to high. Its discrimination is correlated with a geometrical progression of vibrational frequencies. The pitch of a pure tone is central to its volumic pattern, and represents a salient in the intensity of the total mass. Intensity is gauged by the rise of the pitch salient together with the total mass. Duration is the orderly progression or protensity of the sound in time. Brightness is the emergence of the pitch salient from its volumic mass. It is dependent upon the pointedness of the pitch salient, but not necessarily upon the intensity of the sound. Low tones are usually mellow or dull; they are also diffuse or voluminous. High tones are usually shrill or bright; they are also small, piercing, deficient in volume.

There are three kinds of sound: tones, vowels and noises, having the characteristics, respectively, of tonality, vocality and noisiness.

Tonality embraces fusion and the relatedness of intervals. Musical interval is based upon volume distance, but there are special functions that regulate combinations with respect to all the attributes. Fusion rests upon coincidence of volumes and relational effects of the pitch salients made possible by certain functions of the ear and brain. The interdependence of pitch and volume is indicated by the atonal character of very high and very low sounds of regular vibrational frequency. In the former case volumic differences are too small, and in the latter case the pitch salients are too slight, to permit fusion or define intervals.

Vocality is a characteristic of sounds having regional pitch, but no salients. Volume differences by halves, corresponding to the octave interval, seem to govern the order of the chief vowels.

Noisiness is a characteristic of sounds in which the salient pitches are confused or irregular.

Analogies Between Behavior and Complex Mental Processes. W. B. PILLSBURY, University of Michigan.

Animal and human learning has been analyzed into two distinct processes: hitting upon a successful response, and accepting it as successful. All appreciate that this offers two problems, one regarding the origin of the successful responses, the other regarding the nature of the acceptance of one as successful.

The same distinction may with profit be made of what are regarded as the more complex mental operations. I long ago

suggested that conclusions in reasoning were attained by a process of trial and error. We can extend the notion to formation of concepts and percepts, as well as to the memory processes, where it was first noticed. Recall is usually a tentative operation, with many suggestions offered by association, and recognition as the stamp of success. Concepts arise in the course of thought after many conjectures and the rejection of many proposals. A case may be made for the development of percepts by the same method.

If this analogy holds we must carefully distinguish two problems often confused, the one of the origin of the suggestions: habit, instinct, association, etc., the other of the means of testing: pleasure or satisfaction, recognition, belief, or what not, that may be pictured as the name for selection.

An Experimental Study of Adolescence. C. RAHN, University of Illinois.

One of the purposes of this study was to discover whether in the case of normal adolescent males any relation exists between mental and physical functions on the one hand, and sexual rhythm on the other. Throughout a period of ninety days a free-association-test, a multiplication-test, and a dynamometer-test were given daily; and a record taken of dreams, of prevailing moods, and of organic conditions. The results reveal certain typical changes (1) in the curve of energy-output, (2) in affective coloring, (3) in alimentary functions, (4) in intellectual efficiency, and (5) in associational processes—as correlates of different phases of a periodic organically determined sexual “set” or tendency. It is the relation of associational tendencies to the periodic factor that we wish to report upon here. This relation is revealed in the free-association-tests and in the dream-records. In the association-tests 20 stimulus-words were given daily. The first ten were chosen entirely from the list of Woodworth and Wells. The results from these first ten words were used to obtain the daily average of reaction-times. These reveal no striking variations that might be attributed to the periodic function. Scattered throughout the second ten words of the daily list were three “critical” stimulus-words. Two of these were regularly taken from some dream-account of the subjects. The third was always one that is in common use to convey non-sexual meanings, but is at the same time the possible carrier of another meaning that is sexual in character. Here the results indicate a correlation between the organic periodic

factor and modifications in the response to certain specific stimulus-words, both with respect to manner of reaction, and with respect to meaning. Another indicator of a relation between an organic sexual rhythm and changes in associational processes is to be found in the temporal distribution of the erotic dream. This distribution indicates that the periodic organic set involves, among other things, a lowering of the threshold for those associative connections which, upon becoming active, give to the dream, under the influence of this particular set, an erotic coloring. We would not deny the significance of the environmental factor as a determinant of the dream-content; but we would point out that the organic factor takes its place alongside of the environmental. In fine, we have found that much that has been attributed to mythical psychical "complexes" can be definitely referred to specific organic conditions.

Rate of Pupillary Dilation and Contraction. P. REEVES, Research Laboratory of the Eastman Kodak Company.

In the first part of this experiment instantaneous flashlight photographs were taken of the pupils of two subjects for eight brightness levels, including total darkness at one end and the just tolerable reflection of full sunlight from white paper at the other end. The effect of exposing one or both eyes to the sensitizing field was determined for both subjects throughout the brightness range.

From these curves six brightness levels were chosen and the pupils of six subjects were measured, one of the first subjects being used in this series to check the method. In this part of the experiment a motion-picture camera was used and a lamp bank displaced the flashpowder.

The rate of closing of the pupil was measured by taking motion pictures of an eye fully adapted to darkness, hence maximum diameter, as it closed to a diameter almost its minimum. The same six subjects served as well as two others and the average pupil closed in less than five seconds. The greater part of the contraction occurs within the first two seconds.

The rate of opening was determined for seven subjects, the above six and one other, as the pupil opened from near a minimum to a maximum diameter. The average pupil required from three to ten minutes to reach its maximum diameter.

The plotted curves of these results are similar in shape though marked individual differences are shown as well as variations in the results from the same subject on different days.

Interference of Will-Impulses. A. A. ROBACK, University of Pittsburgh.

The purpose of this investigation was to find out what happens when there is a rapid alternation of two sets of will-impulses, and in what way they affect one another. The problem was divided into two parts: (a) Simple finger movements recorded on a kymograph in response to visual stimuli; (b) writing impulses recorded on rolls of paper to the dictation of words, numbers, geometrical figures and other symbols.

In the simple movement experiments, the variations comprise comparisons between (a) lateral and downward reactions of forefinger; (b) downward reactions of forefinger and middle finger; (c) downward reactions of middle finger and ring finger; (d) flexor and extensor reactions of forefinger; (e) spontaneous and controlled reactions. The left hand was used for all experiments. Every one of the thirteen subjects who took part in the simple movement experiments emphasized the easier reaction at the expense of the more difficult one. Thus, the downward reaction was favored in comparison with the lateral; the forefinger reaction was objectively preferred to the middle-finger reaction. Likewise the middle finger was favored as compared with the ring finger; and the flexor movement of the forefinger was far in advance of the extensor movement in the number of reactions.

The objective results showed that there was a universal tendency to take the course of least exertion, calling into play the following phenomena: (a) a leveling process; (b) rhythmic activity; (c) grouping of mistakes; (d) random reactions. The most important conclusion in regard to the introspective results is the retroactive inhibition of determining tendencies, the most specific being the first to be disturbed and the last to be reinstated; while with the most general determining tendency the reverse is true.

The handwriting experiments gave evidence of many phenomena such as automatism, graphic stammering, slurring of vowels; and furnished us with an extensive scheme of graphic inhibition. But, the most significant result here is the fundamental difference between the sensory and the motor phase of inhibition. Sensory inhibition is characterized by dissimilation; motor inhibition by assimilation, assimilation to be understood in the sense that one element tends to resemble another. The Ranschburg inhibition, in spite of the generally accepted view, does not hold on the motor side. Our results, because of the material used,

tend to disprove the Freudian theory of speech and writing lapses, or at least to confine its validity to a very restricted range.

Some Experiments in the Transfer of Habits in the White Rat. H. A. RUGER, Teachers College, Columbia University.

The first part of the experiments was concerned with an attempt to determine the effect of preliminary semi-circular canal practice on the subsequent ability of the rat to learn the Hampton Court maze. A series of rats were carried in a closed car several times around the correct path of the Hampton Court maze. They were then tested by being placed in the maze under the usual conditions and their learning reactions were recorded. A control series was employed in which no such preliminary training was used. In general the results were negative in so far as evidence of effect of the semi-circular canal practice was concerned.

In the second part of the experiment the effect of certain variations of conditions were studied such as the following: (1) The last half of the maze was learned, the blind alleys being closed; the blind alleys were then opened and the effect on the habits set up was studied; (2) the last half of the maze was learned first, and then the animals were allowed to run the whole maze and the character of the reactions in the last half was recorded; (3) the maze was rotated 90 degrees and 180 degrees; (4) the maze was lined with black paper to disguise certain of its features. In most of these four cases there was some disturbance of the old habits when the new conditions were introduced, but the effect was relatively slight and the old habit soon asserted itself.

The Work of the Committee on Classification of Personnel in the Army. W. D. SCOTT, Carnegie Institute of Technology.

This committee was formally authorized by the Secretary of War on August 3, 1917, and empowered to put into actual practice in the Army, certain methods which have already been found useful for classifying men, and also to experiment in an attempt to devise new methods for classifying men in a way helpful to the Army.

This committee has coöperated with all of the agencies of the Army which have to do with promoting or selecting men and of assigning them to that sphere in the Army in which they may be of the greatest use.

On the Genesis of Ideas of Inferior Spirits. W. T. SHEPHERD, Washington, D. C.

The paper presents the results of a psychological examination of typical ideas of spirits as held by different peoples, ancient and modern. The writer attempts inductions as to the mental factors involved in the conception of spirit ideas. He believes that such an examination warrants the following as at least partial explanation of the question of spirit ideas: (1) The imagination has been a most important factor in the genesis of such ideas; (2) credulity has been a factor; (3) fear has in some cases been concerned in the genesis, *i. e.*, in impelling to such conceptions; (4) reverence and love for dead friends have, in some instances been concerned; (5) natural phenomena have played a part; (6) the phenomena of sleep and dreams may have been concerned.

Psychological Wants of Psychiatrists; a Psychopathic Hospital Point of View. E. E. SOUTHARD, Psychopathic Hospital, Boston.

Discussion of wants might lead to a definition of needs. The psychiatrist approaching psychology has some initial lacks largely due to the peculiar individualism of physicians.

The reader will attempt to enumerate the special ways in which psychiatric diagnosis and psychiatric theory at the Psychopathic Hospital would be benefited by new tests and new points of view on the part of the psychologist.

The Forgetting Curve as Affected by Conditions of Learning. E. C. TOLMAN, Northwestern University.

It was shown by the author in a recent investigation that work undertaken immediately after the learning period causes relatively more retroactive inhibition for lists of nonsense syllables learned in an inefficient working period than for lists of nonsense syllables learned in an efficient working period of the day.

The present experiments attempt to discover if there may not be in addition some consistent difference between the forgetting curves for materials learned under the two conditions. Our results, in the first place, seem to indicate that the initial drop in the curve is greater for the material learned in the inefficient working period than for that learned in the efficient working period; secondly, they present some evidence that retention after twenty-four hours is nevertheless nearly or quite as great for the material learned in the inefficient working period as for that learned in the efficient working period.

We conclude that there must be some fundamental difference between the nature of the learning impressions made under the

two conditions which will explain not only this difference between the forgetting curves but also the greater retroactive inhibition earlier found for the inefficient condition.

A Synaptic Theory of Affective Intensity. L. T. TROLAND, Harvard University.

The nervous system can be regarded as a complex network of conductors, every portion of which is connected with every other portion. If this network is treated by analogy with a system of electrical conductors, the distribution of excitation over it at any time should be determined by (1) the distribution of exciting forces and (2) that of internal conductivities. The former corresponds with the stimulus pattern, the latter with the pattern of synaptic conductivities at the various levels of afferent-to-efferent transfer. Assuming an hereditary *tabula rasa*, the conductivity of any synapse at any time should be equal to the time integral of the rate of change of its conductivity throughout the individual biography.

According to classical psycho-physical theory, the introspective consciousness is directly dependent solely upon some part of the cerebral synaptic excitation, in the highest and most comprehensive region of neural adjustment. The proposed theory postulates that the introspectable affective intensity—the degree of conscious pleasantness-unpleasantness, treated as an algebraic variable—is at every instant proportional to the sum of the rates of change of conductivity in these cortical synapses. It follows from this postulate that, on the cortical level of transfer, the pattern of synaptic conductivities at any time should be determined by the time integral of the affective intensity, experienced by the individual up to that time, in connection with each cortical synapse.

Alteration in synaptic conductivity may be ascribed to three main influences: (1) increases due to the direct action of stimulus forces, (2) increases due to the action of stimulus forces *via* hereditary mechanisms of facilitation and (3) decreases due to the action of stimulus forces *via* hereditary mechanisms of inhibition. The theory of these influences involves a discussion of habituation and instinct.

The correspondence of the consequences of the general theory with the facts is considered.

Sound to Light: Conditioned Reflex. A. P. WEISS, Ohio State University.

The aim of the experiment is to investigate intensively a typical human conditioned reflex with a view toward determining the neural conditions when a choice reaction is made between two simultaneous stimuli, but to only one of which the reagent is instructed to respond.

The experimental conditions are as follows: The reagent reacts to a telephone buzz by depressing a key. He is to react only to the sound. He is to keep his reaction-time within a certain limit. When he is reacting too slowly a red light flashes before him, urging him to "speed up." The sound is given irregularly at an average rate of about one per second. With each sound a visual stimulus (electric light) is also presented, but in fifteen per cent. of the reactions the light is given without the sound. The number of times the reagent gets "caught" (by the light) measures the extent to which the visual stimulus has been substituted for the auditory stimulus. Each sound-light complication series is followed by a sound-only series which is used as a control.

The factors studied in the substitution of the light for the sound stimulus are: (1) The "internal" factor or those instances in which the reagent reacts "spontaneously" when neither sound nor light are present. (2) The influence of the "speeding up" process. (3) The influence of the intensity of the substitution light.

EDUCATIONAL PSYCHOLOGY

Objective Measurement of Relative Size of Units in a Judgment Scale.

S. A. COURTIS, Detroit Public Schools.

Twenty-eight quadrilaterals were submitted to a group of adults and arranged by them in order of size on basis of visual judgment only. From the resulting data the relative sizes of the figures were computed in terms of the smallest sample, making use of the "equal difference" theorem. The zero point of the series was then estimated and appropriate samples selected to form a scale for area. The area of the same figures in square inches was then determined by means of a planimeter and the relative sizes of the units in the judgment scale compared on an objective basis. The data were too few to yield conclusive results, but tend to show that unit differences in area (differences noticed by 75 per cent. of the judges) were greater for large areas than for small.

A Comparison of Two Types of Learning by Means of a Substitution Test. C. T. GRAY, University of Texas.

It is the purpose of this paper to report the results of an investigation in which two types of learning have been compared. Such a comparison is made from four different standpoints: (1) by means of learning curves, (2) by a compilation of errors, (3) by means of retention tests, and (4) by means of transfer tests.

The material which was used is in the form of a substitution test. Each letter in the alphabet is replaced by a number combination. The material to be translated into the code is placed on the left of the page. In transcribing this material the problem of the learner is to transfer the digits in the number combinations into short horizontal lines. Another important feature of the test is that the number combinations are made up according to a definite system, which shows itself readily when the letters are arranged in their alphabetical order.

The test had been given in two different ways, which may be spoken of as Method I. and Method II. Those who worked according to Method I. had the printed sheet, with the alphabet and the number combinations before them at all times. In the second method, the alphabet was torn from the sheets. Those who worked according to this plan had the organization of the code explained to them.

The curves procured from the two types of learning show that Method II. makes for a wider distribution of ability than does Method I. The curves for those who show great proficiency by each method differ also in their form. Such curves for Method II. begin lower than those for Method I. and remain so for some time.

A number of the records made in the substitution test were checked for errors. The general conclusion to be reached here is that in the earlier periods of training there are more errors in Method II. than in Method I., while in the latter part of the experiment there is very little difference in the number of errors made in the two methods.

Tests were also made upon transfer and retention according to these two methods.

Determinants of Error in Spelling. L. S. HOLLINGWORTH, Teachers College, Columbia University.

The present report is a fragment of a somewhat extensive research in the psychology of special disability in spelling. In the course of this research, a study was made of the factors which work either intermittently or constantly to cause error, and of those

which tend to limit its extent. Two points are presented at this time in detail: (1) Knowledge of Meaning as a Determinant of Error, and (2) Factors Limiting the Extent of Error.

(1) Knowledge of Meaning as a Determinant of Error. Thirty words were pronounced to the children who were the subjects of the research, with instructions to spell each word, and to give its meaning by writing a sentence containing it. The result showed that the children misspelled their misused words much more frequently than they spelled them correctly; and that they misused their misspelled words much more frequently than they used them correctly. In order to establish the reliability of the result a second list of words was given in the same way, with the same outcome. The conclusion is that knowledge of meaning is in and of itself an important determinant of error in spelling.

(2) Factors Limiting the Extent of Error. It was demonstrated that the average deviation from the correct number of letters among misspelled words is very small; that there is a constant tendency for misspellings to be slightly too short; that misspellings are composed more often than not exclusively of letters included in the correct spellings; that the percentage of error varies greatly with the position of a given letter in the word, the initial letter being almost always right, and the first half of the word having a great advantage over the last half; that incorrigibly poor spellers show the same tendencies in these particulars as are shown by the rest of the group, excluding them.

The Spelling Ability and Vocabularies of 200 College Students.
E. MURRAY, Wilson College.

Each student of the freshman, sophomore, junior, and senior classes was asked to estimate her spelling ability as good, poor, or medium. She was then subjected to a written spelling test based upon a list of 20 non-technical words, selected from the average vocabulary of college written work. Rank in this test was then correlated with the self-estimates, and with rank in freshman English. Cases of low spelling ability were made the subject of special investigation.

Each student was further asked to estimate her reading vocabulary as extensive, limited, or average. The Terman and Childs Vocabulary was then presented as a group test, with directions to calculate the number of words known out of the hundred. Definitions of the last twelve known words in the list were then called for.

The resulting scores were then correlated with rank in freshman English, and in spelling, and with self-estimates.

In the case of the senior and junior classes, correlations were also calculated between the scores in these two tests and class-estimates (by the method of relative position) of general mental ability; and with scores in cancellation tests.

"Part" vs. "whole" Methods in Learning Nonsense Material. L. A. PECHSTEIN, University of Rochester.

It has been shown that certain modified forms of the "part" method are more efficient for mastering a complex motor problem than the "whole" method. In this paper are presented the results obtained from the several novel methods when nonsense series are being learned. The method of "paired associates" is utilized. Comparative results are offered for the following methods: (a) "whole" method; (b) pure part method; (c) direct repetitive method; (d) reversed repetitive method; (e) progressive part method. University students are used for subjects.

Elements in Reading Ability. D. STARCH, University of Wisconsin.

The paper reports a series of experiments designed to ascertain the importance of various factors in reading ability, such as span of visual attention, rapidity of eye-movements, rapidity of association, and control of speech functions.

MENTAL TESTS

A Study of Apperceptive Abilities. A. L. BRONNER, Juvenile Court, Boston.

Definition by different psychologists of the term apperception shows divergence both of meaning and significance. Limiting the term to the most widely accepted usage we may evaluate certain mental tests largely involving apperception to find correlations between these tests themselves and between them and tests for other mental processes. We may also note individual differences in apperceptive ability and the extent to which some individuals show variations in different fields, for example in their performance of tests dealing with concrete material as compared with those involving language. The findings in a group of delinquents are of special interest, particularly in so far as they have a bearing on the interesting question of the relation of apperception to conduct careers.

The Stanford Revision as Applied to College Students. H. H. CALDWELL, University of Wisconsin.

The Stanford Revision tests for adults were given to fifty students of the Randolph-Macon Woman's College, half of whom were sophomores and half juniors. In addition to these a small group of seniors were tested. The writer had first-hand acquaintance with the work of every girl examined, through either class room or laboratory; and to guard against any influence which personal opinion might exert upon interpretation and grading, the tests were given by six seniors of the class in Mental Tests, who had been thoroughly trained in the technique.

The ranking of the students in the tests is compared first with their general intelligence as estimated by several members of the faculty and student body, and second with their average grades since entering college. Sophomores are compared with juniors as to average intelligence quotient, and correlations between this and estimated intelligence and grades. Examination is then made of the tests which were most often failed in, by students having a high intelligence quotient and by those whose intelligence quotient was average. Two main facts seem evident from this examination. The first is that alternate 2, in the Average Adult Test, which calls for "comprehension of physical relations" is not adapted to women and girls. To the half dozen men examined by the writer, with intelligence quotients varying from 92 to 118, it seemed to present no difficulties. The second conclusion is that in the Superior Adult Test, too much stress is laid upon immediate memory. There are six tests, two of which are of this character. Several exceptionally good students, whose general intelligence was estimated to be high, had intelligence quotients indicating only average intelligence because of failure to pass these two tests and number 5 of the Average Adult Group, which is similar. Alternate test 1 of the Average Adult Group proved a stumbling block for these same persons. These failures all showed a poor auditory memory span. It would seem that at least one of these tests might be replaced by one not involving auditory memory.

On the whole, the tests correlate well with both estimated intelligence and college grades, and may therefore be taken as a fairly good method for determining the intelligence of adults. The writer considers it the best method yet available, but believes that it will ultimately be superseded by the use of special tests for special abilities.

The Frequency of Deficiency among Delinquents. J. B. MINER, Carnegie Institute of Technology.

The results of some score of studies, embracing Binet examinations of over seven thousand delinquents, were reinterpreted on a common basis. The proportions testing presumably intellectually deficient and doubtful were indicated in a table. These borderlines corresponded roughly to the lowest 0.5 per cent. and the next 1.0 per cent. of the general population. Comparison was made between groups in state prisons, reformatories, county and city institutions. In general the least deficiency is probably to be found among delinquents from the juvenile courts, contrary to a common opinion. The most deficiency is found among the reformatory groups of women and repeaters in local jails and work-houses. Estimates of deficiency among delinquents should be compared for the type of institutional group considered.

The Learning Curves of the Analogies, Mirror Reading and Alphabet Tests. F. A. C. PERRIN, University of Texas.

The investigations reported in this paper deal with the learning curves of three mental tests. For each of the tests employed, new material was given the subject at each trial or sitting; the curves therefore represent the progressive ability to react to new content in the light of experience with similar content, rather than the ability to improve in repeating identical material. The analogies test was chosen because of its seemingly high correlation with intelligence; the mirror reading test was selected because it promised to show a relatively pronounced amount of improvement. The alphabet test seemed to be intermediary between the two. Ten different lists of 25 analogies each were given to 30 subjects, one list each week; and the time was recorded for each of the 250 analogies. The mirror reading material consisted of prose selections, reading from right to left, printed in capitals, with punctuation marks omitted. The material was practically meaningless. Seven readings, in successive weeks, were made by each subject. Each reading consisted of 72 lines; time was recorded for each 12 lines. For the alphabet test, two complete alphabets, with each letter printed on a separate cardboard, were used. The 52 letters were arranged in random order for each trial, in two rows. The subject constructed a third row, making a complete alphabet in correct sequence, his time being recorded for this performance. The same subjects were used in all the tests. They were personally

selected from the student body of the University of Pittsburgh, and represent extreme cases of either good or poor scholastic ability.

A number of specific questions were in the mind of the experimenter in conducting the tests. The general question of whether practice tends to differentiate individuals or to make them more homogeneous was the principal one. Results were obtained by plotting curves, and by making correlations. Some of the correlations established were: between initial records and average records, and between initial performance and subsequent performance—two distinct things; between good and bad records and variability; between good and poor records and improvability; and between all of these results and intelligence. In addition to these findings, the investigation discloses something of the nature of the mental processes elicited by the tests.

Results of Tests on Learning in Eighth Grade Pupils, and University Students with the Yerkes Multiple Choice Apparatus. P. R. DAWSON & J. P. PORTER, Clark College.

The apparatus used was essentially the same as the earliest model of the Yerkes Multiple Choice apparatus, except that a small lamp is made to light up instead of the sounding of a buzzer, when the correct key is pressed. One hundred and twenty-two eighth-grade pupils and eighty university students have served as subjects. With each subject the four relations—first key to the left, second from the right, alternating first on left and first on the right, and the middle key—were used. The subject was often asked for introspections. Each subject was instructed to state the relation which was being used just as soon as he was certain he had learned it. This apparatus and the method thus far used would seem to be of promise in measuring rate and methods of learning to a large degree independently of the use of language by the subject. We find then in these tests very favorable conditions for the experimental study of the effect of definite mental attitudes and ideas. The hand often hovers over the correct key to be moved at the last second by the conscious voluntary choice of the subject and then presses the wrong key. The movement of the hand often proves to be right while the conscious discrimination is yet uncertain or mistaken. Statistical results on this point are not yet available. "Intelligence quotients" have been computed in the usual way for groups of the eighth-grade pupils. Some pupils had previously been promoted from Room 9 to Room 10. Some had been allowed

to add German to their schedule if they were given high rank by the teacher. More from these two groups stand higher also in "intelligent quotient" rank than from the group of whose ability the teacher's estimate is not so favorable. A measure of learning ability may be found in the ratio of the quotients of test 2 with those of test 1, those of test 3 with test 2, etc. There may be a positive correlation not only of these ratios with total test rating but also with school grades and the teacher's estimate. Aside from definite quantitative results this apparatus and method of experimentation do give us very favorable conditions for more adequate analysis of the learning process.

Norms of Irregularity, on Point and Stanford Scales, for Normal and Feeble-minded Children, and Deteriorated (Insane) Cases. S. L. PRESSEY, University of Indiana.

The paper is a brief summary of about two years' study (made largely at the Boston Psychopathic Hospital, but being continued at Indiana University) of differences in the make-up of examinations, at the same mental ages, obtained from different types of cases. Exact methods for the statement of irregularity, on both point and Binet scales, have been developed. On the point scale, averages were worked out for normal and feeble-minded children, feeble-minded adults, and for dementia præcox and chronic alcoholic patients. Analogous figures for the Stanford scale with normal and feeble-minded children, and normal and feeble-minded adults, have also been secured. A greater irregularity has been taken to mean a difference in the make-up of the score, and thus called for analysis by test; for each group the record on each test of the scales has been found.

Irregularity is, with all the groups, fairly constant at the different mental ages. On both scales the adult feeble-minded show a greater irregularity than normal or feeble-minded children. Analysis shows that the examinations obtained from adults differ markedly in make-up from the examinations of the normal children (on whom the scales were standardized) of the same mental age. The unsatisfactoriness of these scales for work with adults would seem demonstrated. For more than a very rough indication of mental status in adult defectives, tests and methods especially planned for such work are needed.

The psychotic cases gave an irregularity even greater than that shown by the adult feeble-minded. Analysis shows that here again

certain tests are most affected. These tests were grouped to make a special differential unit; the irregularity in these tests alone gave results of considerable differential value in distinguishing deterioration from primary amentia.

A higher irregularity was noticed also in cases of malingering, handicap in the examination because of physical illness, emotional disturbance, and illiteracy. Irregularity may thus give an indication as to the reliability of an examination—its freedom from such factors as those mentioned above.

It is argued in conclusion that irregularity, as a statement of the make-up of a score on a psychological examination, is second in importance only to the total of that score; an exact statement of the irregularity should be part of the findings for every examination.

The Rank-Tangential Coefficient. B. RUMI, Carnegie Institute of Technology.

In much practical work, where mental tests are used as the basis for the diagnosis of intelligence, the end desired is the breaking up of a large group of individuals into smaller groups, each of which will contain individuals of similar ability. The knowledge of two facts is necessary in order to make such a selection intelligently: first, one must know the percentage that should be selected in order that the least possible error be made; and second, one must have an index of the efficiency of selection at the preferred percentage.

The rank-tangential coefficient is an index of the efficiency of selection for any division of the total group. It is designated by the letter t , and is computed by the formula,

$$t = \frac{M(N + 1) - 2\Sigma(R_x)}{M(N - M)},$$

where N is the number of cases in the total group, M is the number of cases that are selected, and $\Sigma(R_x)$ is the sum of the ranks in variable X of the M best or worst individuals in variable Y . The best individual is given rank 1; and the denominator is taken positive if good individuals are selected, and negative if poor individuals are selected. The Y variable is the instrument of selection and the X variable is the criterion by which the success of selection is to be judged.

The rank-tangential coefficient has several properties which recommend it as an index:

1. It varies between $+1$ and -1 , taking these values only in cases of perfect selection. It is equal to 0 for selection such as would in the long run be expected by chance.

2. The rank-tangential coefficient measures the relation in much the same terms as the product-moment coefficient of correlation, and in certain special cases these coefficients are the same.

3. The rank-tangential coefficient describes a property of tests, knowledge of which is important in the judgment of diagnostic value, and in the making of the diagnosis.

4. The rank-tangential coefficient is computed with great ease.

Some Spatial Relations Tests. L. L. THURSTONE, Carnegie Institute of Technology.

These tests are intended to tap the ability to think in three dimensional terms. The tendency toward bi-modality in the distributions may be taken as one form of evidence that space thinking belongs in the category of special abilities rather than in that of general intelligence. Record scores have been made by very young subjects while other subjects who score high in the general intelligence tests fail entirely in the spatial relations tests.

The Hand Test requires the subject to specify for each of forty-nine pictures of hands whether it represents a left hand or a right hand. Spatial Relations Test A requires the subject to imagine a lozenge shaped card turned and fitted into one of several possible outlines. Spatial Relations Test B is a variation of the preceding test. The Kinematics Test requires the subject to trace the direction of motion of machine parts, including spur gears, bevel gears, belts, and worm gears. The Punched Paper Test requires the subject to specify the location of holes punched through folded paper.

Serial Mental Tests of Epileptic and Normal Children. J. E. W. WALLIN, Psycho-Educational Clinic and Special Schools, St. Louis.

A set of 12 different tests (administered so as to constitute 16 separate tests), arranged in five consecutive series approximately equal in difficulty, were given as group tests every 28 days during five months to squads of epileptic and normal school children. The tests were designed to measure the strength of a variety of mental traits, and the amount of change which might take place in these traits during the time of the experiment.

Based on the averages for the five monthly series the efficiency of the epileptics varied in the different tests from 15 per cent. to 80 per cent. of the normals' efficiency. Their average efficiency in all the tests was 48 per cent. of normal efficiency. In half of the tests they did less than 35 per cent. as well as the normal. They did relatively better in the simpler, sensory and motor tests than in the more complex, intellectual tests.

The epileptics did relatively better in the amount of improvement made during the experiment. They gained 64 per cent. as much as the normal pupils. In relative amount of improvement (the gain expressed as a per cent. of the efficiency scores) the epileptics gained more than the normals in most of the tests. This was due to the low initial scores made by the epileptics.

Judged by the records of the normal squad, the epileptics ranked lowest in pedagogical efficiency (35 per cent. of normal). They graded decidedly lower by the monthly group tests than by the Binet-Simon, partly due to the greater difficulty of the epileptics to respond in writing than in speaking. But the group tests probably gave a truer measure of their intellectual level than the Binet-Simon.

The Use of Mental Tests in Selecting Pupils for a Gifted Class.

G. M. WHIPPLE, University of Illinois and Carnegie Institute of Technology.

At Urbana, Illinois, fifteen fifth-grade and fifteen sixth-grade pupils, selected by the principal and teachers "on the records made in their school work, their health, industry and application," were, in October, 1916, placed in a special class, where, when permitted to proceed to the extent of their ability, they succeeded, with certain exceptions, in accomplishing in the one year, two years of work. During this time these pupils were given a thorough Binet examination, followed by 64 other mental and educational tests. Of these 64, 50 were group tests and of them, 27 were also given, for purposes of comparison, to the control group—the pupils remaining in the two grades from which the special group had been drawn, while to a limited number in the control group were also given the 14 individual tests.

It would seem that this survey of the mental and pedagogical abilities of a group of pupils is as elaborate and thoroughgoing as any that has been reported, and on that account ought to yield significant results. We have been able, indeed, (1) to sort our tests

into three groups, (a) those of high worth, (b) those of medium worth, (c) those of practically no worth in selecting a group of gifted pupils. (2) We have shown that certain pupils had been wrongly placed in the special group, whereas other pupils had been wrongly retained in the control group, and that these mistakes would have been reduced virtually to zero had the pupils been selected by mental tests instead of by the school authorities and their classroom records. (3) We have found that some mental tests may have high value for differentiating degrees of ability within a group of gifted children that have only medium value in separating the group as a group from other pupils. (4) We have been able to draw up a series of percentile tables that will show the expected distribution of performance for pupils of the fifth and of the sixth grade in each of 27 tests. Finally, (5) we have been able by the results of our tests to make a fairly detailed analysis of the abilities of each of the pupils in our special group (including, it might be said, a child with an I. Q. of 167), and this analysis has been, and will continue to be, of very real service to the parents and teachers of these pupils.

All in all, the outcome ought to strengthen the conviction that mental tests possess marked significance for educational administration and also the conviction that gifted children can be, and should be, segregated in special classes in our public school systems.

THE PSYCHOLOGICAL BULLETIN

A NOTE ON MEASUREMENT BY RELATIVE POSITION

BY S. C. KOHS

Buckel Foundation, Stanford University

A few difficulties are generally encountered in the use of Thorndike's method of measurement by relative position.¹ The more important ones are:

- (a) Total agreement between judges is given a value of ∞ .
- (b) One is advised to interpret the value of ∞ as 2 P.E., later on.
- (c) The Δ table is given for divisions of opinions between two to fourteen judges. A table giving P.E. differences up to twenty judges would be a considerable aid.
- (d) Inspectional arrangement of judgments may yield an unreliable lineation of the subjects judged.

The following suggestions may assist the elimination of these difficulties:

(a) "Total Agreement" for judges *under* 100 may be considered equal to 4.6 P.E. And "Total Agreement" for judges *over* 100 may be taken equal to 6 P.E.

(b) In the table which is herewith presented "Total Agreement" is given a value of 4.6 P.E., a figure more in harmony than 2 P.E. with the progress of the judgment-differences.

(c) This table also extends Thorndike's original list to include judgments of from fifteen to twenty judges.

(d) It is advised that instead of arranging a series of judgments by inspection, the arithmetic mean be utilized for this purpose.

Reasons for the Changes.—(a) and (b) Theoretically, if the total

¹ E. L. THORNDIKE, "Technique of Combining Incomplete Judgments of the Relative Positions of N Facts, Made by N Judges." *J. of Philos., Psychol. & Sci. Meth.*, 1916, 13; 197-204.

number of judges agree, placing one fact measured above another, that particular fact is at an *infinite* distance above the other. For practical purposes this limit is given an arbitrary numerical value, which can be made reasonable even though arbitrary. Thorndike originally assigned to ∞ the value 2 P.E. Reference to the original Δ Table will make the incongruity of this value evident. Thus in the case of 14 judges a division of 12 to 2 equals 1.58 P.E.; 13 to 1, 2.17 P.E.; and 14 to 0, ∞ or 2 P.E.! If anything, it should be more than 2.17 P.E. This point is still more striking when dealing with 20 judges. A division of 18 to 2 equals 1.90 P.E.; 19 to 1, 2.44 P.E.; and 20 to 0, 2 P.E.!

Now to reply to the possible query, why 4.6 P.E. has been chosen as the more reasonable value to substitute for ∞ . If we had 100 judges, a division of opinion 100 to 0 equals a difference between adjacent facts or items equal to $\frac{50}{100}$ or 0.500, which equals ∞ . (See P.E. Table.) A division of 99 to 1 equals a difference between facts of $\frac{49}{100}$ or 0.4900, which equals 3.45 P.E. Evidently the 100 to 0 division should be greater than 3.45 P.E. How much greater can be determined empirically by plotting the P.E. values for each division of opinion from 50-50 to 99-1, and continuing the curve onward to 100-0.

Again, if we had 1,000 judges, a division of 999 to 1 equals a difference between facts of $\frac{499}{1000}$ or 0.499 which equals 4.62 P.E. Consequently a division of opinion of 1,000 to 0 should be greater than 4.62 P.E.

Since 100-0 should be greater than 3.45 P.E., and since 1,000-0 should be greater than 4.62 P.E., it seems reasonable to place the 100-0 division of opinion equal to 4.6 P.E. It is deemed advisable not to change, as yet, the value of ∞ from 4.6 P.E. for any number of judges below 100. In fact it is highly probable that most of the studies which will utilize this method will not exceed judgment of over 100 judges. Should tables be devised for judges above 100 it would seem more logical to interpret ∞ equal to 6 P.E.,² which, for practical purposes, is understood to include half the range of a normal probability surface, with the median as the dividing line.

² Further mathematical study is necessary to determine whether the P.E. values for "Total Agreement" should increase as the number of judges increases. There are as many off-hand reasons for arguing progression as for non-progression. More careful analysis of this matter is necessary.

It is an open question whether in educational or psychological data ∞ should ever be interpreted greater than 6 P.E.

(d) Since the final assignment of P.E. values to the various items or individuals judged is dependent upon how accurately the preliminary seriation of the items or the individuals is made, it is essential that this preliminary arrangement of judgments be made as accurately as possible. It is evident that arrangement by inspection is too largely affected by accidental factors and individual idiosyncrasies. This variation in initial arrangement might, with exactly the same raw data, yield different final results in the case of two random inspectors. But this factor of variation in arrangement can be eliminated if the arithmetic mean of the judgments for each fact or individual is found, and the preliminary seriation made dependent on these mathematical results. The arithmetic mean is selected in preference to any other average for the reason that equal weight is given to the opinion of each expert or judge. To the problems which this method has found application here, this procedure of determining the original lineation of items, followed logically our preliminary modification of the Thorndike procedure by directing the judges to assign to the items judged, values between 1 per cent. to 100 per cent. according to the position of a given item in a group with reference to *all* the others in this group.

Applications of the Method.—Mr. F. E. Barr and Mr. E. J. Buckles have been kind enough to permit me to utilize here a portion of their final data in their application of this method to the devising of an occupational scale which they promise for early publication.

Hobo.....	0 P.E.
Track Layer.....	4 P.E.
Metal Finisher.....	8 P.E.
Librarian.....	12 P.E.
Artist.....	16 P.E.
Inventive Genius.....	20 P.E.

It does not require a great deal of psychological or statistical insight to appreciate the general value of such a scale to that suggested by Taussig or Saffioti.

The writer is indebted to Mr. J. F. Abel and Mr. K. M. Cowdery, graduate students in advanced educational statistics, whose wrestling with the problem has led him to this refinement in technique.

Δ TABLE

THE DIFFERENCES IN TERMS OF P.E. CORRESPONDING TO ANY DIVISION OF OPINIONS
AMONG 2, 3, 4, 5, . . . 20 JUDGES

<i>N</i>	<i>D</i>	Δ	<i>N</i>	<i>D</i>	Δ	<i>N</i>	<i>D</i>	Δ	<i>N</i>	<i>D</i>	Δ
2	1-1	0.00	10	5-5	0.00	14	7-7	0.00	18	9-9	0.00
2	2-0	4.60	10	6-4	0.38	14	8-6	0.27	18	10-8	0.21
			10	7-3	0.78	14	9-5	0.54	18	11-7	0.42
3	2-1	0.64	10	8-2	1.25	14	10-4	0.84	18	12-6	0.64
3	3-0	4.60	10	9-1	1.90	14	11-3	1.17	18	13-5	0.87
			10	10-0	4.60	14	12-2	1.58	18	14-4	1.13
4	2-2	0.00				14	13-1	2.17	18	15-3	1.43
4	3-1	1.00	11	6-5	0.17	14	14-0	4.60	18	16-2	1.81
4	4-0	4.60	11	7-4	0.52				18	17-1	2.36
			11	8-3	0.90	15	8-7	0.12	18	18-0	4.60
5	3-2	0.38	11	9-2	1.35	15	9-6	0.38			
5	4-1	1.25	11	10-1	1.98	15	10-5	0.64	19	10-9	0.10
5	5-0	4.60	11	11-0	4.60	15	11-4	0.92	19	11-8	0.30
						15	12-3	1.25	19	12-7	0.50
6	3-3	0.00	12	6-6	0.00	15	13-2	1.65	19	13-6	0.71
6	4-2	0.64	12	7-5	0.31	15	14-1	2.23	19	14-5	0.94
6	5-1	1.43	12	8-4	0.64	15	15-0	4.60	19	15-4	1.19
6	6-0	4.60	12	9-3	1.00				19	16-3	1.49
			12	10-2	1.43	16	8-8	0.00	19	17-2	1.86
7	4-3	0.27	12	11-1	2.05	16	9-7	0.23	19	18-1	2.40
7	5-2	0.84	12	12-0	4.60	16	10-6	0.47	19	19-0	4.60
7	6-1	1.58				16	11-5	0.72			
7	7-0	4.60	13	7-6	0.14	16	12-4	1.00	20	10-10	0.00
			13	8-5	0.44	16	13-3	1.32	20	11-9	0.19
8	4-4	0.00	13	9-4	0.74	16	14-2	1.71	20	12-8	0.38
8	5-3	0.47	13	10-3	1.09	16	15-1	2.27	20	13-7	0.57
8	6-2	1.00	13	11-2	1.51	16	16-0	4.60	20	14-6	0.78
8	7-1	1.71	13	12-1	2.11				20	15-5	1.00
8	8-0	4.60	13	13-0	4.60	17	9-8	0.11	20	16-4	1.25
						17	10-7	0.33	20	17-3	1.54
9	5-4	0.21				17	11-6	0.56	20	18-2	1.90
9	6-3	0.64				17	12-5	0.80	20	19-1	2.44
9	7-2	1.13				17	13-4	1.07	20	20-0	4.60
9	8-1	1.81				17	14-3	1.38			
9	9-0	4.60				17	15-2	1.76			
						17	16-1	2.32			
						17	17-0	4.60			

N = No. of judges. *D* = Nature of division among the judges. Δ = Corresponding differences in terms of P.E.

SPEED OF PRESENTATION AND EASE OF RECALL IN THE KNOX CUBE TEST

BY L. M. RACHOFSKY

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While giving the Knox Cube Test in the individual examinations of Carnegie Institute of Technology freshmen we noticed that the scores of the subjects were markedly affected by variations of the speed with which the examiners presented the test. This suggested promising material for a study of the relation between speed of presentation and ease of recall, a phase of the speed and accuracy problem. Accordingly we undertook the present investigation.

High-school students were selected to serve as subjects. We had found by a few preliminary trials that it would be impossible to use only a few subjects who would repeat the test again and again at different speeds; for they would learn the test so well after a few sittings that practically no variation in the number of errors would occur, no matter at what speed the test were given. Since for the purpose of our experiment a subject could be given the test only once, it was necessary to secure a large homogeneous group, and high-school students most closely fulfilled these requirements. In order to eliminate as many variables and make the group as homogeneous as possible only senior and junior boys were selected.

The apparatus consisted only of the Knox Cube Board, a strip of board twenty by two inches upon which are fixed four colored cubes at intervals of five inches, and a silent pendulum. The subject is seated at a table opposite the examiner with the test board placed between them. The examiner taps the blocks in a certain order, maintaining a constant speed of tapping by means of the silent pendulum. The subject is then instructed to tap the blocks in the identical order. The examination consists of ten such problems, each problem being repeated once before proceeding to the next. One error only is allowed for each problem; thus it is theoretically possible to make twenty errors. A perfect score is extremely rare, so there is opportunity for a good distribution.¹

¹ Pintner, R., "The Standardization of the Knox Cube Test," *Psychol. Rev.*, 1915, 22.

Since the object of the experiment was to discover the relation between the speed of tapping by the examiner and the accuracy of the subjects' recall, the students were divided into several groups of equal size so that each group might be given the test at a different speed. The following speeds were selected: one tap per half second, one tap per three fourths second, one tap per one second, one tap per one and one fourth seconds, one tap per one and one half seconds, one tap per one and three fourths seconds, one tap per two seconds. It would have been desirable to have gone beyond the half second speed, but it was found physically impossible to tap so fast at a constant rate. Neither the time nor the subjects were available to go beyond two seconds. In all cases the subjects were allowed to respond at whatever speed they desired, regardless of the speed at which the examiner tapped.

The results when plotted appear as in the accompanying graph. The abscissæ represent the time per tap in seconds, and the ordinates represent the average number of errors. From this curve it appears

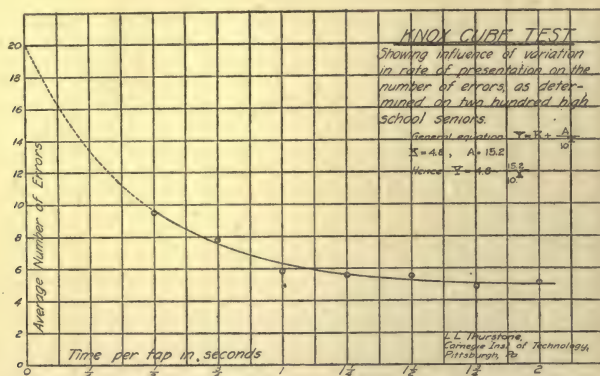


FIG. 1.

that accuracy of recall increases inversely to the rate of presentation; or the slower the examiner presents the test the fewer the number of errors the subject makes. Mr. L. L. Thurstone has stated this relation analytically by the empirical equation,

$$Y = K + \frac{A}{10^x},$$

in which Y represents the average number of errors for about twenty-five subjects, X represents the examiner's speed of tapping

in taps per second, and K is a constant. The dotted part of the curve is an extension of the equation beyond the empirical data. We know that if the test were given at an infinite speed the subject would miss all the problems and the curve would then intersect the Y axis at 20. The significant feature of this curve is that the ease of recall seems to be a continuous function of the speed of presentation in the Knox Cube Test.

It would have been interesting to have continued the experiment beyond the speed of two seconds; for eventually the factor of forgetting would have set in and the number of errors would increase as the speed of presentation decreased. This would finally have resulted in a U-shaped curve.

These results may be of some value in the mental test field, where the Knox Cube Test is extensively employed, notably in the Army tests. The speed ordinarily prescribed for giving the test is one tap per second. Since there is a tendency on the part of examiners to go too fast, and since the curve begins to rise rapidly at one second, a pronounced increase in the number of subjects' errors will result; and the comparability of individual records will be seriously impaired. On the other hand, a mistake in giving the test too slow, while still noticeably affecting the score, would not be so serious as going too fast, inasmuch as the curve begins to drop much less rapidly to the right of one second. The ideal speed would seem to be at about one and one half seconds. Here the curve is almost flat; and a slight deviation of the speed in either direction would be of little practical consequence. Although this curve represents the performance of high-school seniors only, there is no reason to suppose that the same type of function will not hold for other homogeneous groups.

The introspections and reactions of the subjects were recorded. The test is predominately kinæsthetic; and the imagery of the subjects with few exceptions was of this type. In most cases it was associated with either visual imagery for colors or auditory imagery of color names. In a few cases the brighter children assisted their memories by numbering the blocks. Students who relied upon unreinforced kinæsthetic imagery, memory of jumps and directions, rarely succeeded in attaining a score in the upper quintile. Incidentally, one of the explanations of the excellence of the Knox Cube as a mental test is found in the premium it pays to resourcefulness and ingenuity.

In the high speeds the subjects found it hopeless to employ

any but motion imagery. They found it impossible to tap at a slow normal rate; it was only by tapping at the same high speed as the examiner that they could achieve any successful scores at all. In other words, they had only a memory of a rapid succession of bare movement sensations which could be reduced to action only in the same rapid bewildering succession.

It is our intention to make further investigations into the relationship between speed of presentation and accuracy of recall with material which will be presented to the subject but a single time. It would be interesting to discover the same continuous function between speed of presentation and ease of recall with such experimental material as rhythm tests, substitution tests, tachistoscope exposures, etc., as has been presented here in the case of the Knox Cube Test.

GENERAL REVIEWS AND SUMMARIES

VISION—GENERAL PHENOMENA

BY LEONARD THOMPSON TROLAND

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In spite of the War, there has been no dearth of publications relating to vision during the past year. It is natural, however, that most of the articles should emanate from American sources, and that the studies of problems having a practical bearing, especially upon illuminating engineering, should constitute a considerable fraction of the whole.

In this field the problem of the visibility of radiation continues to attract investigation. Coblentz and Emerson (10, 11), in an important monograph, present new visibility data from 130 subjects, by far the largest number yet employed in an attempt to determine the average visibility curve. The flicker method of photometric equation was used, and the maximum of the average curve was found to lie at a wave-length of $557.6 \mu\mu$. Individual variations naturally exist in the position of the maximum, in the spread of the curve and in its symmetry. High red sensitivity is the most common variation. Correction of the curve for the selective absorption of the ocular media gives a symmetrical curve with a maximum at $556 \mu\mu$. Seven partially color-blind individuals were examined, and the results indicate that abnormalities in the form of the visibility curve accompany defective color vision, although the converse is not always true. The age of the observer has a noticeable influence upon the form of his curve.

The same authors (12, 13) compute the value of the "mechanical equivalent of light," on the basis provided by their new visibility data, as 0.00162 watts/lumen. In other words, one watt of radiant energy of maximal visibility is equivalent to 617 lumens of light, or 49.1 candles. The luminous efficiency of an ordinary tungsten lamp is found to be 1.42 per cent., referred to the maximally visible radiation as a standard.

Foote (21) develops a new equation for the visibility curve, based upon results previously obtained by Ives and Kingsbury. It

is more complex but also more accurate than Nutting's equation. Coblentz and Emerson (10) also discuss the visibility equation, and offer an amplification of the form proposed by Nutting. Göthlin (22) finds that the energy threshold for radiation between 680 and 820 $\mu\mu$ is an exponential function of the wave-length—of the form, $E = e^{(a\lambda - b)}$ —for a three-degree macular field, but deviates slightly from this relation for a strictly foveal field. E is the threshold, e the base of the natural system of logarithms, λ the wave-length, and a and b are constants.

Hyde and Forsythe (29) have determined the temperatures of the ideal "black body" which correspond in color to various common illuminants, such as candle, gas, and kerosene flames, and different types of incandescent filaments. Kingsbury (39) has made similar measurements on gas flames under different conditions. These results—although seemingly physical—are all actually dependent upon and indicative of psychophysical constants or laws.

A number of articles deal with the question of the smallest quantity of radiant energy which can be visually perceived. Ives (30), the previous year, had calculated the radiation reaching the retina from a sixth magnitude star to be 38×10^{-10} ergs/sec./cm.², assuming a pupillary diameter of 6 mm. Russell (54) finds that under the usual conditions of astronomic observation the pupil is 8.5 mm. and that stars of a slightly higher magnitude than the sixth can be seen when there is a minimum of diffuse light in the sky. The corrected value of the minimum visible is 7.7×10^{-10} . This corresponds to about two hundred physical "quanta" of radiation entering the eye per second, and would amount to only one erg in forty years. Reeves (46, 48) attacks the same problem freshly with a direct experimental procedure and obtains an average value of 19.5×10^{-10} for three observers. An "artificial star," one millimeter in diameter and viewed at a distance of three meters, was employed; and the pupil, photographed by flashlight, had an average opening of 8.3 mm. Buisson (8) also reports an experimental determination yielding a value of 12.5×10^{-10} . Coblentz and Emerson (10), in discussing this same subject, point out that the retina is 300,000 times as sensitive as the best modern radiometer.

Reeves (47, 49), in general papers on pupillary and retinal adaptation, summarizes many of the important results recently obtained in the Eastman Laboratory, showing in a quantitative way the response of the eye to different levels of illumination.

The same investigations are also expounded by Hunger (28). Practically all of this work, which is of great value, has already been published in other articles.

Ferree and Rand (20) report a continuation of their previous investigations concerning the influence of different types of interior illumination upon the efficiency of the eye. Various forms of pendant, opaque reflectors were employed in the present work, and the ability of subjects to sustain clear seeing was the principal criterion applied. The same authors also present a general review (19) of their work on this problem. Their results indicate that the distribution of light is of more importance than absolute intensity in influencing visual efficiency, extremes of surface brightness being very undesirable. Semi-indirect reflectors of high density seem to be most conducive to eye comfort.

Ferree and Rand also reply sharply (18) to Johnson's criticism of their proposed method for heterochromatic photometry, and defend their experimental technique as well as the effectiveness of the method. Priest (45) discusses further his new procedure for the photometry of lights of different colors, in which he utilizes the rotary dispersion of quartz to obtain distributions of energy in the spectrum similar to that of the light which is to be photometered. Although the method is primarily physical, a study of its technique would repay those who are especially interested in the accurate control of complex visual stimuli.

Jones (37) reports a very thorough and accurate determination of the thresholds for hue difference throughout the spectrum. Expressed in terms of wave-length units, this threshold exhibits four minima and three maxima, the former occurring at 637, 585, 594, and 443 $\mu\mu$, the latter at 624, 538, and 464 $\mu\mu$, respectively. Between 400 and 700 $\mu\mu$, 128 threshold steps exist, and the smallest value of the threshold is 1.0 $\mu\mu$ at 588 $\mu\mu$. Although the measurements are on only one subject, they agree well with those previously published by Steindler. On the basis of these threshold determinations a "fundamental scale of pure hue" is established, practical applications of which are discussed.

Abney (1) presents measurements to show that in certain subjects a small proportion of rod vision exists in the fovea. Determinations were made on such subjects, who have a foveal "photochromatic interval," of the amount of "rod white" aroused by light of different wave-lengths. The spectral distribution curve of this "rod white" corresponds with that of ordinary rod vision,

but the absolute quantities indicate the relative insignificance of the process in the fovea. Abney finds (2) that subjects with night blindness have no photochromatic interval, the absolute threshold being the same as that for color in the normal eye. Göthlin (22) states that in his own foveal vision there is a photochromatic interval for red after adaptation to an illumination of 1,000 meter-candles, but for the totally dark-adapted eye a complete absence of the interval! According to this author, protanopes have a color threshold, between 640 and 760 $\mu\mu$, which is 16 times the light threshold. For the normal, dark-adapted eye, the rod and cone threshold curves intersect at 660 $\mu\mu$.

Arps (4) describes experiments which show that complementary mixtures of red, green and yellow matched in luminosity with mixtures of blue and yellow do not remain matched when the general illumination is lowered or when their relative positions with respect to the center of vision are exchanged. These facts are inconsistent with the Hering theory, but are not new.

A number of papers deal with after-image phenomena. Swindle (57) continues his discussion of positive after-images of long duration, and states that slight changes in illumination—properly timed—may revive such after-images with startling vividness. This observation is applied in an ingenious manner to the explanation of the traditional ghost, both nocturnal and diurnal apparitions being considered. The influence of changes of illumination upon after-images is also discussed by Troland (59), who finds that a faded after-image can be revived in negative form by dimming its projection field, or in positive form by brightening the latter. The effective duration of the after-image can thus be increased many fold. Brilliant color changes result when spectral stimuli are employed. Both the dimming and brightening effects can be explained on the assumption that the excitation of a retino-cerebral region temporarily lowers its resistance to alterations in any given state of excitation. Swindle points out that, owing to self-induction, colors tend to exchange places in an after-image, as compared with the original stimulus.

Ferree and Rand (16) report observations which show that areas can be found in the peripheral visual fields of many persons which are relatively blind to red, green, yellow, or blue, but which are not correspondingly deficient in the complementary after-image and other related reactions. The location of these spots varies from subject to subject. Sahni (55) discusses the colors seen through

the closed eyelids, and offers an obvious explanation based upon ocular blood-flow and after-image effects. Baumann (6) writes on the colors produced by Benham's top and similar devices. Crane (14), in a paper which is admirable in method, corroborates Kirschmann's law that maximal color contrast is conditioned by minimal luminosity contrast, and finds that the function connecting the two is symmetrical with respect to the maximum point. Cook and Kunkel's finding that light colors exert more color contrast effect than dark colors is attributed to the usually greater saturation of the former.

Two papers deal with binocular color mixture and retinal rivalry. Dawson (15) asserts that when the proper precautions are taken, no difference can be perceived between the luminosity or the color of an object seen with one eye and with two eyes. Rivalry between the two retinal fields increases with increase in the difference between the fields in any dimension: hue, saturation, luminosity, or contour. Luster is due entirely to luminosity differences. Baumann (6) describes a luster effect obtainable in monocular vision. Kuroda (40) discusses "mosaic retinal rivalry," in which the two retinae contribute simultaneously to the contents of different parts of the "common visual field," and finds that similar features have a tendency to appear together, regardless of their retinal source. In general, the rivalry between any two corresponding retinal points is independent of that between other corresponding points.

Luckiesh (41) describes observations on the apparent distance from the eye of red and blue letters. When actually equidistant, seven observers found that the red letters appeared to be closer, while for two observers the blue seemed to be nearer. By the use of an artificial pupil the effect could be reversed or annulled, according to the position of the pupil. Other papers dealing with problems of the perceptual type are those of Ruckmich, Riddoch, Basler and Arps. The first (53) finds that temporal patterns of colors tend to be thrown into groups with accented members, producing a subjective visual rhythm. Riddoch (52) reports on a number of cases of wounds in the occipital region of the cranium. His observations corroborate the views of Holmes and Lister with regard to the representation of the retinae on the cortex, and show that in the process of recovery the perception of movement precedes that of form. Basler (5) discusses phenomena involved in the perception of black lines on a white ground, while Arps (3) deals

with the visual discrimination of rectangular areas under various conditions of illumination.

The literature on vision for the year includes a number of significant theoretical papers, the majority of which are mathematical in method. Ives continues the development of his very successful and important theory of flicker and allied phenomena. In an article on "visual diffusivity," (33) he develops certain consequences of the view that this factor varies with the intensity and quality of the stimulus and with the species of receptor. He shows that the interval between perception and reception should be inversely as the diffusivity, and finds that experimental determinations of this interval for different colors and intensities, and for the rod as compared with the cone process, harmonize with the demands of the theory. In a second paper (34) Ives describes a new flicker photometer in which the two lights to be alternated are substituted for one another in accordance with a pure cosine law (of intensities as a function of time). With this instrument he has been able to meet the requirements of his original theory of the flicker photometer, and accurately to verify the theory in its application to critical flicker frequencies. He finds that the brightness discrimination fraction for the ultimate visual receivers with the flicker procedure is 0.00018, an astonishingly low value. The theoretical dependence of flicker-photometer frequency upon color difference is also discussed by Ives in a third paper (35), in which he shows that the experimentally established relationships can be explained on the basis of the threshold scale of hues and the color mixture triangle, without bringing in the visibility curve, as suggested by Troland. In a fourth paper (31) Ives discusses the possibility that the sluggishness of the visual process may be due to an inertia factor in the receptor mechanism, rather than in the conducting medium, as previously supposed. Grünbaum (23) finds that optical fatigue diminishes the ability to recognize flicker, but that on recovery from fatigue the ability rises above normal.

Nutting (43) summarizes the recognized laws of photochemical action, and develops a general mathematical expression for such action, which is consistent with the facts of visual and photographic sensibility, including the phenomenon of threshold. Troland (61) presents some further developments of his previously published formulation of the chemical theory of sensory response, showing that his equations explain Fechner's law, with its deviations. Some of the constants of the theory are roughly evaluated on the basis of

empirical data. In the same paper, it is shown that recognized facts relating to the electrical action of the retina can be combined with the Nernst-Lillie theory of nerve excitation to explain the continuous and graded conduction of visual intensities to the optic brain centers. Houston (26) offers a non-mathematical exposition of his theory of color vision, which is critically examined by Guild (24).

A general and very popularly written book on vision, *The Sense of Sight*, by Spindler (56) appears in the series on "Our Senses and What They Mean to Us." It is probably not intended to contain any new contributions to the subject. Reeves (50) presents a popular discussion of the evolution of vision.

A few articles bearing on vision from the comparative point of view may be mentioned briefly. Swindle (58) cites interesting observations tending to prove that the "eye appendages" of certain animals function so as constantly to vary the intensity of the light falling upon the eye, thus preventing the disappearance of fixated objects as a result of local adaptation. The photosensitivity of the skin of the fish, *Epinephelus striatus* Bloch, has been demonstrated by Jordan (38) to comply with the Bunsen-Roscoe law of photochemical action, and to decrease with continued stimulation. Hess (25) reports observations indicating that the color vision of poultry is similar to that of man, except for a relative blue-blindness. Patten (44) describes careful experiments on the reaction of the whip-tail scorpion to light, which show this animal to be typically negatively phototactic, but lacking in any power visually to perceive objects or movements. The intensity threshold of its response is 0.16 meter-candles, and the increase of response with intensity follows a saturation curve with an asymptote which is approximately reached at 1.0 meter-candle.

Among articles relating to experimental technique is one by Troland (60) on the measurement of visual stimulation intensities, which summarizes for the psychologist the principles of visibility and radiation, in the light of recent investigations. The relative merits and significance of radiometry and photometry, the justification of the flicker photometer, and the definition of equal heterochromatic luminosities, are other topics discussed. The final object of the paper is to define a practical unit of retinal illumination, the *photon*, in which the influence of intra- as well as extra-ocular factors is taken into consideration. Formulæ are developed for the application of this unit in connection with the artificial pupil. Ferree and

Rand (17), replying to critics of their previous articles, emphasize once more the theoretical advantages of radiometry as an objective measurement of visual stimulus intensities. They deny that extant visibility data can be regarded as furnishing an adequate calibration of the normal eye in energy terms, but admit that it may often be of more value to equate intensities of response than intensities of stimuli.

Reeves (51) reviews the literature on color filters, and describes in particular the valuable filters produced by the Eastman Kodak Company for research purposes. Luckiesh, in a long paper (42) which is full of useful information, gives exact spectral transmission and reflection curves for many common and special substances. A thoughtful study of this paper will be of advantage to many psychologists who are accustomed to use colored papers and glasses in visual experimentation. Johnson (36) offers a somewhat new design for a spectrometer intended for visual work, in which lenses are replaced by mirrors, which do not suffer from spherical and chromatic aberration. Clayden (9) describes a simple diffraction spectrometer, with a concave grating, designed to mix two homogeneous beams. Hübl (27) gives a description of a compact three-color-mixing apparatus, using half-silvered mirrors, color filters and neutral tint wedges, and intended for color matching. A "limen color mixer" which permits the mixture of colors in small and accurately determinable ratios is offered by Weiss (63). Rotating disks are employed on a principle similar to that previously applied by Hyde to the sector disk of the spectrophotometer. Only small stimulus areas can be obtained. Boring (7) presents a note on the substitution of gray papers of different luminosity for the black and white papers ordinarily used in class-room experiments with the method of equal sense intervals, and in the Kirshmann photometer. They have the advantage of being more permanent and of requiring less delicate means of angular measurement.

Ives (32) describes an improved visual acuity test-object, based upon the principle of crossed gratings. Gratings ruled in squares are employed so that the interference figures are also squares, of continuously variable size. A "focal variator" is offered by Weiss (62). This instrument permits objects or images to be presented to the eye with any desired degree of definition and allows of the accurate measurement of the latter.

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HEARING

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Baird (1) reports a study of memory for absolute pitch as evidenced experimentally in nine musical observers. For the instruments used the order of ease of identification was, piano, organ, flute, clarinet and voice. With pure tones identification was poor. As regards the scale, the middle section was least difficult for all observers. Those pitches an observer can sing were generally the ones most easily identified, but there was no perfect coincidence of the two regions. "Naturals" were more readily identified than "accidentals," but in more than half the mal-identifications neither accidentals nor naturals were recognized as such. It therefore seems impossible to accept the common statement that accidentals are perceptually similar as a class, and perceptually different from the class of naturals. Individual differences were marked as regards the relative ease and difficulty of certain notes. From the total average it appears that *F* and *C* were most accurately identified with the piano, and *G* and *C* with the organ; while *C#* and *Bb* proved the most difficult with both instruments. There was a general tendency to judge low tones too high, and high tones too low. Overestimations of pitch were relatively more frequent with the piano tones, and underestimations more frequent with the organ tones. Confusions of pitch were not based upon identity of overtones, since there was a greater confusion of notes between which the relation of the *fourth* obtained, than between those where the relation was that of the *fifth*. The most frequent confusions were of notes least subject to fusion. Octave errors were frequent, and found to be wholly different in nature from note errors. Observers were very accurate with some notes, and inaccurate with others. It was found that a note was more likely to be confused with its *third* or *sixth*, than with its *fourth* or *fifth*. The author finds his results pointing to the existence of certain *quales* of C-ness, D-ness, etc.; and he is doubtful if memory for absolute pitch can be acquired through training. In reaching these conclusions he fails to refer to the possible significance of distance-intervals as the possible basis for judgments of absolute pitch, or to Köhler's suggestions on the subject of training.¹

¹ Cf. PSYCHOL. BULL., 1916, 13, p. 192.

Cameron (3) found among six subjects that four benefited by practice in singing tones at two different pitch levels, 100 and 225 v.d. Improvement was restricted to the pitch level practised, though an improvement in steadiness and uniformity of the tone sung was transferred to the other level. There was also an accompanying improvement in pitch discrimination at the level practised, but this was not transferred. A general tendency was manifest to sing the low tones too high, and the high tones too low. There was greater accuracy of pitch discrimination, than of motor ability in the reproduction of tones. The source of sound was an electrically driven fork communicated by means of a telephone receiver, and the registration of the tones sung was made on a smoked drum with the aid of a Cattell voice-key.

Seashore and Mount (19) report correlations of factors in musical talent and training selected from groups of test records made in four different years. In all, seventeen experimental tests were included, supplemented by answers to four questions regarding musical training, environment, expression and the enjoyment of music. The first series embraced a test for pitch discrimination and answers to the four questions. The second included these, and in addition tests for singing keynote, interval, scale and a test for singing the least producible variation from a sung note. The third series comprised tests for pitch, consonance and intensity discrimination, free rhythm, regulated rhythm, singing, auditory imagery, motor imagery and answers to questions regarding musical training, environment and the enjoyment of music. The fourth series included all the experimental tests of the third, except singing the scale and singing discriminative intervals. In addition, there were tests for hearing ability, time-sense, motor ability, rhythmic judgment, voluntary control of pitch and tonal memory. The minimal numbers of persons tested for the full series of each group varied from 190 to 225. The various tests were those devised and tried out in the Iowa Laboratory of Psychology with a view to standardization for application in the diagnosis of musical talent. One is struck by the prevailing lowness of the correlations. Positive correlations above .5 are found only between musical training and musical expression; between the four tests of singing; between tonal memory and pitch; and between tonal memory and the voluntary control of pitch in singing. Between hearing ability and pitch discrimination the correlation was .12; between musical enjoyment and consonance the correlation was negative, $-.02$,

in two series. One also notes very small or negative correlations between time-sense and rhythm: free, regulated, and rhythmic judgment. The authors conclude that the rhythmic tests are unreliable, but they assert the validity of the consonance tests, adding that "the burden of squaring musical procedure with these facts is therefore passed on to the musical profession."

Malmberg (8) attempts to discover the ranking order and to standardize the perception of consonant intervals. Tests were made with the piano, tuning forks and pipe organ. The ranking order was found to vary slightly with the different instruments, but no considerable differences could be attributed to the use of just and tempered intonation. The criteria adopted for consonance were: (1) blending—a seeming to belong together; (2) smoothness, or relative freedom from beats; (3) fusion, or unanalyzability and (4) purity, or a resultant analogous to a pure tone. These criteria were freely discussed with the eight observers, who worked together and used the method of the jury in reaching their conclusions. It was found that blending, purity and smoothness were consistent criteria by means of which the following rank order was attained: *octave, fifth, major sixth, major third and fourth, minor sixth, minor third, tritone, minor seventh, whole tone and major seventh, semi-tone*. With fusion alone as the criterion a different order was reached, approximately as follows: *octave, semi-tone, whole tone, fifth, minor third, major third, fourth, tritone, minor sixth, major sixth, minor seventh, major seventh*. Excepting the *octave* and *fifth*, this is an order based on increasing size of interval, though the author does not appear to have noted the fact. The first order is accepted as the standard for consonance and is compared favorably with the results of group tests previously secured; discrepancies being attributed to failure in the group tests to eliminate the factor of agreeableness. A system of weighting errors was worked out, and the distribution of grades reveals very great diversity of capacities among normal observers. As previously remarked, the perception of consonance is found to correlate very slightly with musical training and musical performance, and is accordingly regarded as "elemental in a secondary sense in so far as it is based rather on the elemental capacities for pitch discrimination and tonal memory." It may be noted, however, that the correlation with pitch discrimination was only .18, and with tonal memory .34. Malmberg does not refer to the experiments of Kemp² and Valen-

² Cf. PSYCHOL. BULL., 1914, 11, p. 100f.

tine,³ though his results show interesting correspondences with both.

Gaw (6) has revised Malmberg's consonance test for practical purposes by eliminating undesirable intervals, simplifying the definition and conception of consonance, and adopting a system of demerits for the purpose of grading results. In the revision each interval appears at least once. There are eleven comparisons embracing a consonant with a consonant interval, a semi-consonant with a semi-consonant interval, a dissonant with a dissonant interval, and each of these three with each of the other two. The scheme is as follows, the more consonant interval being given first:

- Octave with semi-tone, 11 demerits*
- Octave with major seventh, 10 demerits*
- Fifth with major seventh, 9 demerits*
- Major sixth with major seventh, 8 demerits*
- Major sixth with whole tone, 7 demerits*
- Fifth with tritone, 6 demerits*
- Major third with minor seventh, 5 demerits*
- Fifth with minor sixth, 4 demerits*
- Major third with minor third, 3 demerits*
- Major seventh with minor seventh, 2 demerits*
- Fourth with major third, 1 demerit*

The instruction is: "A good combination (of two tones) is one which is *smooth*, in which the two tones *blend*, and seem to *agree* and *fuse together* into one. A bad combination (of two tones) is one which is *rough*, in which the two tones do not *blend*, and do not *seem to agree nor fuse together* into one."

Gordon (7) reports on tests of learning simple musical themes in comparison with learning specially constructed series of nonsense syllables, in which there were the same number of syllables as notes in the corresponding musical theme, with syllables repeated wherever a note was repeated. She found her observers divided into musical and non-musical groups. The former learned the musical themes with a median of 4 repetitions, and the nonsense syllables with a median of 6.5. The unmusical group learned the music with 13 and the syllables with 8 repetitions. Learning the same themes and syllables backwards gave a higher median for the music with both groups. There appears to be less difference in the ease of learning musical themes and nonsense syllables than between the learning of nonsense syllables and meaningful words. The

³ Cf. PSYCHOL. BULL., 1915, 12, p. 163.

author concludes with a suggestion of a test for musical appreciation based upon the comparison of memory for significant and non-significant musical selections. Dashiell (4) has tested color and musical effects upon 212 kindergarten children. The musical tests were made with five intervals produced on the piano: the *major third*, *fifth*, *octave*, *major seventh* and *semi-tone*. Each interval was liked by a majority of the children. The number of affirmative to negative votes varied from 193 to 5 for the *major third*, to 111 to 87 for the *semi-tone*, the others ranging in the order given above. The writer suggests alternative interpretations which, however, hardly seem to constitute a dilemma. The first is that children lack esthetic sensibility; the second, that the esthetic sense is present but still plastic, and might develop along different lines than it does, if social conditions were other than they are.

With a specially devised apparatus in which resonators were moved towards and away from a suspended vibrating fork, Weiss (27) has secured results from judgments of intensity involving the comparison of 55 arbitrary steps with 6 standard positions of intensity. For the range selected an average of nine j.n.d.'s were found. By extending the intensities to include very loud and very weak tones, he estimates an average discrimination of twenty-five degrees of intensity. There follows an interpretation of the intensity reaction in terms of M. F. Meyer's theories of hearing and behavioristic response. This involves an ingenious schematization of nervous flux and distribution which, however, has no bearing upon the special interests of this summary. Richmond (16) also describes an apparatus for producing changes of intensity in sound without a click or other qualitative modification. A small electric buzzer of high pitch is run by a single dry cell, while a second cell through an inductorium, gives an independent current interrupted with the same frequency as the buzzer. Variations of resistance in the current through the inductorium produce changes of intensity in the sound without modifying the amount of current flowing through the buzzer magnets. A telephone receiver actuated by a secondary coil of the inductorium gives a tone of the same pitch as that of the electric buzzer. The arrangement permits a smooth change of sound intensity without other disturbances.

Miller (12, 13) describes his modifications of the Henrici Harmonic Analyzer, which increase the analyzable components from 10 to 30. The instrument is used in the registration and analysis of photographed sound waves. A 32-element harmonic synthesizer

is also described which makes possible a graphic presentation of each single component of a complex curve in its proper size and position, and also the resultant of all the components. Such a synthesis is useful in checking the analyses of photographed curves. The instrument will also draw corrected curves after allowances have been made for instrumental disturbances, etc.

In his study of binaural beats, produced by two slightly different tones separately conducted to the two ears, Stewart (21, 22, 23, 24) analyzes the wandering localization as "in front at 0 degree difference of phase, on the side of the fork with the higher frequency leading in phase from 0 degree to 180 degrees, and on the side of the slower fork with the higher frequency leading in phase from 180 degrees to 360 degrees, the changes of position being continuous, from front to rear (or within the head) and from rear to front." The localization was much more distinct in the half cycles in which the lead of the faster fork varied from -90 degrees to $+90$ degrees. With experienced observers the change in localization at 0 degree phase difference by the production of a very marked inequality of intensities was found to be slight. With attention upon intensity instead of localization, three distinct maxima were found: (1) at 0 degree difference of phase; (2) at 180 degrees $-\delta$, and (3) at 180 degrees $+\delta$, δ being less than 45 degrees. The existence of these secondary maxima of intensity lead the author to assume that their effects are due to conduction from one ear to the other through the head. The binaural beat period must be greater than two to five seconds in order to produce these secondary maxima. The conclusion reached opposes Peterson's contention that binaural beats are of cortical origin. According to Stewart the primary maxima are independent of beat period and are due to direct excitation of the ear drum and organs of Corti. The secondary maxima, on the contrary, are produced by conduction through the skull, and are attributed to distinct organs of hearing, presumably located in the saccule and utricle. The necessity of assuming a distinct organ of hearing for sounds due to bone conduction is perhaps obviated by Bing's conclusion (2) that such sounds are directly effective in the labyrinth, and are not conducted by way of the drum and ossicles, as has been usually supposed. Bing supports his views both by a theoretical consideration of sound effects upon the drum and ossicles, and also by references to clinical practice, particularly in the administration of the Weber, Rinne and Schwabach tests. With the Weber test sounds are

localized in the poorer ear when there is interference to air conduction in this ear. The facts are illustrated by Mach's experiment when a sound presented to the right ear is heard in the left one, if the left ear passage is closed with the finger. The sound is conducted from the right ear across the head to the left labyrinth. Its passage outwards being interfered with, it is heard in the left labyrinth. If with this test the sound is only heard in the right ear, the conclusion is that the deafness of the left ear is due to an affection of the nervous apparatus. The Rinne test consists in holding a vibrating fork against the skull behind the ear until the sound dies out. The fork is then brought before the ear passage and will normally be heard again; showing the greater sensitivity of the ear to air conduction. If it be not heard again the cause of deafness may be attributed to stoppage in the middle ear. A clinical case is cited in which the drum and ossicles of one ear were completely destroyed, while the other ear remained normal; yet it was still possible for the patient to hear with the defective ear by means of bone conduction.

In a note which fails to reveal the experimental basis of his conclusions, Sizes (20) elaborates his conception of the predominant tone of a sonorous body as the median term of a progression of eight octaves extending both below and above it. The musical sound is said to be a consequence rather than a cause of harmony. The intensity of the predominant sound is attributed to the coexistence of a large number of inferior, but separately imperceptible partials. In this complete harmonic series the median or predominant tone occurs between two adjacent notes, each separated from it by the interval of the *fifth*; hence, the important musical relations of *C* to the *G* above and the *F* below. Watson (25), investigating the transmission, reflection and absorption of sound by different materials, finds that porosity, density and elasticity all function in determining transmission. Porous bodies transmit sound in much the same proportion as they transmit air. Density stops sounds in proportion to the density. Elastic bodies transmit sounds if they are in tune with them. If the pitch is varied, porous and elastic walls will reflect the high-pitched sounds in greater degree than the low-pitched ones.

Marage (9) reports results of treatment with the vowel siren of different sorts of deafness incident to the war. Ten per cent. of his cases showed lesions of the middle ear, and all were amenable to treatment; 38 per cent. evidenced cerebral commotions, and of these

50 per cent. were cured. The remaining 52 per cent. were diagnosed as involving both forms of disturbance, and yielded 76 per cent. of cures. The treatment, details of which are not given, lasts five minutes per day, and 68 per cent. of unselected cases were able to return to the front. The author points out that auditory re-education of this type is not a matter of pedagogy, and should be undertaken exclusively by qualified medical practitioners. The same author (10, 11) describes the use of the vowel acoumeter in detecting deafness, real and assumed. He criticizes the ordinary methods in force which do not even allow for the proportional decrease in the intensity of sounds with increase of distance from the source. Ranjard (15) reports on 100 cases of soldiers's deafness treated by the Marage method, in 84 of which positive results were obtained.

Watt (26) describes the results of measurements of the basilar membrane made by him from the photographs in A. A. Gray's *The Labyrinth of Animals* (2 vols., London, 1907-1908). He finds the cochlea to be built according to a constant plan in which the scale alone varies from specimen to specimen. There is a high correlation between the scale and the size of the organism as a whole. Variation in the number of whorls from the typical number, two and one half, occurs without any alteration of the basal plan of the cochlea. The cochlea grows by accretion at the apex, not at the base. There are two sources of change in the length of the basilar membrane. The chief of these is its own absolute increase in length, accompanying a greater number of whorls. The other is attendant upon a relative increase in the diameter of the tube. In length, the basilar membrane of man does not rank high among those of other animals, nor is man's cochlea the most regular and beautiful organ. The absolute length of the basilar membrane is not important for efficiency of hearing. Length in relation to the size of the organ as a whole is what counts. Perfection of efficiency is attributable to elasticity of the membrane and its relative length.

In R. Tigerstedt's *Handbuch der Physiologischen Methodik*, K. L. Schaeffer (17) contributes the section on methods of investigating the acoustical functions of the ear. A wide range of instruments and methods are considered with special regard for physiological procedure and results.

Seashore (18) points out the importance of avocational, as well as vocational tests, and cites the field of music as being one in which much time and money is wasted on the education of unfit

subjects, while persons who would profit by a musical education are often neglected. A set of tests is described embracing pitch discrimination, the sense of consonance, intensity discrimination, auditory memory and imaginal type. These were devised for fifth-grade pupils, and are being given in selected schools for the purpose of discovering incipient musical talent. The best ten per cent. of those tested are being followed up and encouraged to study music. Reference is also made to a special device for administering individual motor tests in which the basic powers of action, such as speed, accuracy and precision of voluntary movement, both in time and form; simple and complex reaction-time and timed-action, are registered graphically with a single instrument. Pond (14) applies the method of introspection in learning to play the French horn, and finds that although the mental processes involved are complex and intricate, the detection of errors is greatly aided by introspection. The resultant improvement of technique points to the value of such a method in connection with musical instruction. Gale (5) criticizes the prevailing methods of musical education, and points particularly to the lack of understanding of the musical classics on the part of teachers, and to the teaching of instruments rather than musical compositions, musical history and the musical ideas of great composers. He advocates the distinction of professional training, which should be undertaken in properly conducted conservatories, and musical culture, which should be within the province of schools and colleges. The private teaching of music could well be suppressed. Chamber music undertaken by small groups of amateurs is regarded as a better avenue to musical culture than the usual struggle to organize school and college orchestras. Individuals should also be taught to read music imaginatively, even though they may lack the technical facility of first-rate performers. Music should be removed from the "elocutionary" plane, and made a subject similar in import and value to the study of poetry. With less of discipline, and more attention given to the range of classical compositions; less of harmony and counterpoint, and more vivid recourse to musical history and the lives and ideas of eminent composers, music would find its highest function in the home, rather than in the concert hall, and become an art understood and appreciated by adults, and especially by men.

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Le Courage. L. HUOT & P. VOIVENEL. Paris, Alcan. 1917.
Pp. vii + 358.

This book, to which M. Étienne, former minister of war, contributes a glowing preface, is a work not only of science, but of imagination. It was written in the shelters at the front. One of the authors, Huot, is, or was, a divisional army doctor with extensive military experience in the colonies, the other, Voivenel, an adjutant attached to the sixth French battalion. Both are shrewd and scientifically trained observers, and the book has accordingly high value as a first-hand study of the psychology of the soldier; both also are ardent patriots, and from the literary point of view the book is one more illustration from the war of the ability of French writers to express in words, as her soldiers are expressing in deeds, the passionate soul of France. An epigram in the chapter on "L'âme nationale" sums it all up: "On aime son pays comme une femme. On se bat pour lui mieux que pour une femme." It is amazing to see a work of this sort so richly documented. One does not exactly expect to find a *bibliothèque nationale* in the *cagnas*, yet here we have evidence not only of extensive personal observation, but of wide and varied reading; innumerable precise bibliographical references, direct citations from philosophers, scientists, military publicists, novelists and poets by the score. Moreover, the authors announce the preparation of a volume on *le Cafard* and one of them has actually found time to write, and has ready for publication after the war, a treatise on the psychology of smell, finding rich new material in the battlefield and the trenches! Evidently the popular impression of life at the front is in some need of modification.

Courage is defined as physical and moral steadfastness in the face of death, and heroism is to courage as genius is to talent. In the strict sense it implies the readiness of the individual to sacrifice his life to an ideal. It is the triumph of the instinct of social conservation over the instinct of self-conservation, of altruism over egoism. Hence, according to our authors, it is never found among animals, nor among the lowest races of man. The animal, even when it fights fiercest, obeys the instinct of conserva-

tion, of which the sexual and maternal instinct are expansions, and this instinct, so far from inciting to courage, is its most powerful antagonist. The same is true of the lowest savages; they live in the depths of forests, have no elevated sentiments, are impelled solely by self-interest, fight preferably from ambush, and in the paroxysm of combat are dominated by the instinct of conservation. Huot gives illustrations from his experiences in the African colonies. On the other hand, man is not so limited in his evolution as the animal, and even savages are capable, under discipline and imitation, of developing an *esprit de corps* and a fine loyalty of devotion first to their friends, finally to an idea. Huot cites, again from his African experience, the case of the brave Senegalese. At its best, in heroism, courage finds expression in the pure sacrifice of the individual without any reflected self-interest. It becomes, in fine, a religion. Everything depends on the presence of an ideal. "Of all things human the ideal is the most superhuman. The ideal makes man, the ideal is the mark of his superiority. A man dies from the death of his ideal, as the earth would die from the death of the sun. It is for this reason that *courage*, the sacrifice of the individual to the ideal, is at once so common and so wonderful, the imperishable flower of humanity."

The psychology of courage begins with the consideration of fear, the first manifestation, by its tendency to flight, of the instinct of conservation. A physiological theory is proposed which professes to combine the views of James and Sollier: there is a splanchnic fear of the psyche, and this supports James, and there is also a more intellectual fear of the *nous*, and this agrees with Sollier. But apart from the questionable accuracy of the representation of the doctrines of these authors, the mediation suggested is confused by the terminology, for, according to the scheme of the nervous system adopted, the "psychic," also called the intelligent, brain (Grasset's O center, Flechsig's association zones) is the highest, being distinguished both from the "organic" brain and from the visceral cœnæsthesia of the sympathetic system and the medulla oblongata. And in general it must be said that our authors contribute little to the general physiological theory of the emotions, being only too ready, as they express it, to watch the theoreticians at their exercises and to adopt and adapt each theory in turn as occasion serves. Much more important is the collection of observations and reflections in the chapters dealing with the anatomy of courage, with courage as affected by habit and experience, by the love of risk,

the sanctions which control fear and the contagion of collectivity, and as it manifests itself in battle. The chapter on the battle is one of the great chapters of the book. It deals with conditions before, during and after the battle. It follows Crile in its general theory and seeks to show that immediately before the assault the potential neuro-cerebral energy is in a state of tension, that during the combat all this potential energy is being used up, and that afterwards there is exhaustion. "I am all right physically," officers say, after a period of rest, "but I have not yet recovered morally . . . my spirit of offensive has not yet returned." Here again it is not the commonplace theory which is of chief value, but the vivid record of observed facts.

One returns in the end to the central thesis that courage in the form of heroism is the acceptance of the sacrifice of the individual to the ideal, the most exalted of the virtues. This may be so. Undoubtedly the ideal is the inspiration by which, in the large, heroism is engendered and sustained, and we do well in regarding objectively the sacrifices of the soldier as expressing his devotion to the country and its ideals. But we do not need to go beyond the pages of this book to see that this motive is crossed by others less sublime. There is, for instance, what our authors call the autoserotherapy of fear, the fear of death, of mutilation, of disgrace, which counteracts fear and keeps a man steady in the face of danger, and on the positive side, there is, as they also point out, the love of "glory" and of decorations. And if we look to the actual mental state of the soldier, do we not find that in the great crises the high inspirations fall away and that, so far from being exalted, it is reduced to something like the level of brute instinct, or even automatism? A French officer known to the writer described his own mental state during a charge as a perfect blank save for the blind impulse to go on and reach the goal. The two views are not incompatible, that war is "exaltation" and that war is "relaxation," and books like the present furnish the data by means of which they may in the end be reconciled.

H. N. GARDINER

SMITH COLLEGE

REPORT

DEFINITIONS AND DELIMITATIONS OF PSYCHOLOGICAL TERMS

PREPARED BY A COMMITTEE OF THE AMERICAN PSYCHOLOGICAL
ASSOCIATION

FOREWORD

At the Chicago meeting of the American Psychological Association a committee was appointed "to consider the matter of uniformity in the usage of psychological terms."

The committee selected for examination a number of the more fundamental terms used in psychology. It was deemed inexpedient at present to recommend one definition exclusively for each term. Much of the confusion in recent discussions of psychological facts and concepts seems due to mutual misunderstanding of the different meanings attached to the same term by the various writers. Accordingly in some cases the committee found it desirable to recognize several distinct and incompatible alternative meanings for a given term. These alternatives were admitted, however, only where they represent the usage of a considerable number of writers.

After thorough discussion the committee agreed upon a tentative formulation of definitions and comments. These were printed and submitted to 150 psychologists for criticism. 60 replies were received and on the basis of these the report was revised. In certain cases the phraseology was amended; in other cases definitions were rejected or reduced to comments. The order of definitions was changed so as to conform with the majority preferences of the 60. It was found that the proposed definitions fell into three rather distinct groups as regards acceptability, with modes at 90, 60, and 30 per cent. respectively. Definitions falling in the lowest group were for the most part rejected or reformulated; a few have been retained and are indicated by a dagger (†); that is, *definitions marked with a dagger represent the usage of a relatively small number of psychologists.*

The final formulations are given below. The report is un-animously approved by the committee, despite the fact that its

members represent very diverse standpoints. It should be understood, therefore, that in many cases the definitions given do not represent the personal usage of every member of the committee. In the case of certain fundamental terms the formulations are to be regarded as *delimitations* rather than definitions.

DEFINITIONS AND DELIMITATIONS

I

1. Psychology:

- a. The science of *mental phenomena*.
- b. The science concerned with the mutual interrelations of *psychobiological organisms* and their *environment*.
- c. †The science of *selves*^a in relation to their *environment*.
- d. †The science of mental *behavior*. [See Note at end.]

COMMENTS: 1. *Psychology*^a is intended as a general definition from any introspective standpoint. *Psychology*^{b, c} are special definitions from "psychobiological" and "self" standpoints respectively.

2. Systematic *psychology* includes the facts of other disciplines so far as needed to explain *mental phenomena*.

2. Psychological:

Pertaining to *psychology*.

COMMENT: This adjective is often improperly used instead of *mental* or *psychical*.

II

3. Mental phenomena:

- a. Phenomena characterized by relation to consciousness.
- b. Phenomena pertaining to any of the following: *mind*, *consciousness*, *content of consciousness*, *self*^a, *subconsciousness*.
- c. Phenomena characterizing the subjective relations of *psychobiological organisms* with their *environment*.

COMMENT: It is generally agreed that not all phenomena arising from the relations between organisms and their environment are *mental phenomena*^a; but no criterion of delimitation so far formulated has gained general acceptance. The phenomena attending growth (*e. g.*) would be excluded. The subjective phenomena attending neural reception, integration, and response—*e. g.*, sensation, feeling, thought, volition—are generally included.

4. Mind:

The totality or system of *mental phenomena*^a.

COMMENTS: 1. These mental phenomena may be treated either alone or in connection with the bodily organization on the basis of which they are integrated.

2. *Mind* is also frequently used as a synonym for *soul*, for *psyche*, or for *self*^{ab}. This use is not advisable on account of its equivocal character.

5. **Mental:**

- a. Pertaining to *mind* or its *phenomena*.
- b. Pertaining to *consciousness*.

6. **Mental life:**

Mental phenomena in the process of development and disintegration.

COMMENT: *Mental life* usually emphasizes the persistence of *mental phenomena* during the lifetime of the *individual*; its meaning is sometimes extended to include race history.

7. **(Mental) element:**

A (mental) fact which is apparently simple, *i. e.*, which remains unanalyzed at the present state of knowledge.

COMMENT: In *psychology* the term may be applied to certain *processes*, *items*, and *functions* of consciousness.

8. **Introspection:**

- a. The direct observation of one's own *mental processes*.
- b. †Direct observation of one's own feelings and other processes mediated by the somatic and splanchnic neurons. [See Note at end.]

COMMENTS: 1. It is not proper to apply the term *introspection* to the observation of the *object of consciousness* in the physical sense of the term.

2. The term *self-observation* is suggested as a synonym for *introspection*^a.

III

9. **Consciousness:**

- a. The distinctive basal characteristic of *mental life* in actual process; *awareness*.
- b. The subjective accompaniment of certain neural processes.
- c. †The characteristic relation of *self*^a to its *environment*.
- d. †A generic group of *mental phenomena* characterized by one or more distinguishing features.

COMMENTS: 1. *Consciousness*^a is not equivalent to *mind*, *self*, *soul*, or *psyche*, but is characteristic of them.

2. *Consciousness*^a is generally qualified by an appropriate adjective; *e. g.*, religious consciousness, instinctive consciousness, perceptual consciousness, etc.

3. *Consciousness* is regarded by certain writers as incapable of any real definition.

10. **Subject of consciousness:**

That which is conscious.

11. Object of consciousness:

- a. That of which the *subject of consciousness* is aware.
- b. The *content of consciousness* viewed as a term in the subject-object relation.

12. Content of consciousness; mental content:

- a. The items, collectively considered, which at any time constitute *mental life*.
- b. The constituents of *mental life* at a given moment, viewed from the structural standpoint.
- c. †Specific *objects of consciousness* at any moment.

13. Process of consciousness; mental process:

- a. Change of *consciousness*.
- b. Phenomena of *consciousness* considered as changing.

COMMENT: *Mental process*^a includes the mode as well as the fact of change.

14. Item of consciousness:

Any single phenomenon of *consciousness*.

15. Subconsciousness:

Mental phenomena which in degree of vividness or clearness are below the limen or threshold of distinct consciousness; *subliminal consciousness*.

16. (The) subconscious:

A *mental life* or detached phase of mental life (judged to be present in an *individual*) of which the individual is not directly aware; a subordinate (or coördinate) consciousness.

COMMENT: The psychoanalytic school assumes that *the subconscious* is very highly organized.

17. Unconscious:

- a. A term used to characterize activities of the organism unattended by *consciousness*.
- b. A term used to describe such conditions as those of dreamless sleep and coma.

COMMENTS: 1. *Unconscious*^a is often used to characterize reflex and autonomic activity; it is also used to characterize certain modes of instinctive activity, somnambulism, and perfectly formed habits.

2. The terms *subconsciousness*, *the subconscious*, and *unconscious* are constantly confused. The first two are especially apt to be confused in discussions concerning the existence of *the subconscious*. *Unconscious* is often used in place of *subconscious*, and also to distinguish the inorganic world from the organic. It is recommended that *unconscious* be confined to the uses here suggested, and that *non-conscious* be used to characterize the inorganic world.

18. Awareness:

A synonym for *consciousness*^a.

19. Experience:

- a. Any modification of *consciousness* or the sum total of such modifications.
- b. A psychical modification of the *psychobiological organism* which occurs either as an effect or concomitant of change in the *environment*.

COMMENTS: 1. The transitive verb *to experience* is often used as a synonym for *to be conscious of*, or *to be aware of*, with reference to the *object* or *content of consciousness*. To conform with this the noun (the) *experienced* may be used to denote the specific *object of consciousness* in contrast with (an or the) *experience*^a, *i. e.*, the specific *process of consciousness*. The term *experienter* is correspondingly used to denote the *subject of consciousness* with *to experience* (intransitive verb) and *experiencing* (noun and adjective) to denote the occurrence of the phenomenon.

2. *Experience* is often used as a synonym for *consciousness*.

IV

20. Self:

- a. A conscious *individual*^b, characterized by persistence and by change.
- b. A *mind* regarded as consciously distinguishing itself from what is not itself.
- c. A conscious *individual*^b in union with an organized body.
- d. The *individual* regarded as a progressively organized system of mental functions and processes.
- e. The *subject of consciousness* (or *experienter*) accompanying any complex of *mental processes* attentively experienced.
- f. †A specific complex or integration of *content* in which the body as *object of consciousness* is fundamental.

COMMENTS: 1. The terms *subject* and *experienter* have been used as synonyms for *self*^a. A *self*^a is both *subject* and *object of consciousness*; it is an *object of consciousness* directly, not merely through inference.

2. *Self*^c and *self*^f are never synonymous with *soul*, *mind*, *subject of consciousness*, or *experienter*.

21. Psyche:

The being or nature manifested in *mental phenomena*.

COMMENT: *Psyche* is used as a synonym for *mind*, or as a substitute for the historic term *soul*. In this sense it is employed in recent literature by the followers of Freud.

22. Psychic; psychical:

Pertaining to *mind*, or to *consciousness*, or to *psyche*; *mental*.

COMMENT: *Psychic* is used (in psychiatry) to designate a certain class of disorders. It is also used to characterize a class of phenomena designated as telepathy, telekinesis, clairvoyance, etc.

23. Soul:

a. A somewhat indefinite historic term, formerly used to designate the generic subject-matter of *psychology*.

b. In modern usage, a synonym for *psyche*.

COMMENTS: 1. *Soul*^a has been used historically with the following meanings, often accepted confusedly together: (i) life; (ii) spiritual substance; *i. e.*, a simple, unchanging, incorporeal being; (iii) conscious being; (iv) the moral and emotional consciousness; (v) disembodied spirit.

2. *Soul* is also sometimes used as a synonym for *self*.

24. Individual:

a. A single *psychobiological organism*.

b. A single being, uniquely determined and differentiated.

COMMENTS: 1. The *individual* is usually distinguished from (i) the social group; (ii) the type of a species, etc.

2. *Individual*^b may be applied to *soul*, *self*, etc., as well as to the *psychobiological organism*.

V

25. Psychobiological organism:

A conscious, living unit.

26. Environment:

A term covering all physicochemical, biological, and social phenomena acting from without upon a given *organism*.

27. Behavior:

a. The reaction of an *organism* to its *environment* (biological usage).

b. Those simple or complex changes in an *organism* which

follow or are concomitant with *mental phenomena* and which may be observed in another organism than that of the observer or in his own (psychological usage).

c. †Any mental activity of an organism. [See Note at end.]

28. Behavior psychology:

The systematic presentation of *psychology* in terms of *behavior*.

Note.—The use of the terms *Behavior* and *Introspection* in the senses defined or implied in 1d, 8b, and 27c is sanctioned by a number of writers in good standing. The majority of the committee are of the opinion, however, that such use is likely to cause confusion and misunderstanding.

HOWARD C. WARREN,
Chairman

MARY W. CALKINS,
KNIGHT DUNLAP,
H. N. GARDINER,
CHRISTIAN A. RUCKMICH

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NOTES AND NEWS

THE reorganization of the Council of National Defense, with the National Research Council as one of its divisions, has resulted in the grouping of the psychological work under the section of medicine of the Research Council. The following subcommittees are continued: Methods of Examination of Recruits, Tests of Special Skill, Problems of Aviation, Incapacity and Reeducation, and Visual Problems.

THE following members of the American Psychological Association have been commissioned in the Sanitary Corps of the Army for psychological examining: A. T. Poffenberger, G. C. Myers, S. Isaacs. A full list of those members of the Association who have undertaken special war work has been promised and will appear in an early number of the BULLETIN.

THE medical journals have contained the announcement of the death of Dr. Henry Maudsley, the distinguished English psychiatrist, at the age of eighty-three years.

ON account of the general situation and on account of the number of members of the Society who are engaged in various forms of National Service the Council of the Southern Society for Philosophy and Psychology has decided to abandon the annual meeting which was scheduled to be held at Peabody College, Nashville, Tenn., this spring.

A CORRESPONDENT writes that a Swiss newspaper contained a notice of the death of Professor Ewald Hering, in Leipzig, in February.

THE following items have been taken from the press:

A COMMITTEE on Education and Special Training has been created by the War Department to study the needs of the various branches of the service for skilled men and technicians; to determine how such needs shall be met, whether by selective draft, special training in educational institutions, or otherwise; to secure the cooperation of the educational institutions of the country; and to administer such plan of special training in schools and colleges as may be adopted. The committee consists of Colonel Hugh S. Johnson, deputy provost marshal general; Lieutenant Colonel

Robert I. Rees, of the General Staff; and Major Grenville Clark, of the Adjutant General's Department. The committee will be assisted by the following civilians: Charles R. Mann, Massachusetts Institute of Technology; James R. Angell, University of Chicago; J. W. Dietz, Western Electric Company, president of the National Association of Corporation Schools; James P. Monroe, member of the Federal Board for Vocational Education; and Samuel P. Capen, United States Bureau of Education, specialist in higher education.

THE University of Rochester has expanded its work in psychology, and quarters are now provided for a laboratory which is equipped for experimental purposes. Dr. L. A. Pechstein has been appointed to take charge of the work.

PROFESSOR R. H. SYLVESTER, University of Iowa, has joined the psychological division of the officers' training camp at Fort Oglethorpe, Ga.

DR. FRANCIS N. MAXFIELD, assistant professor of psychology at the University of Pennsylvania, has been appointed psychologist in the public school clinic of Newark, N. J.

PROFESSOR B. T. BALDWIN, University of Iowa, has been commissioned major in the Sanitary Corps.

DR. H. H. GODDARD has been appointed head of the Bureau of Juvenile Research of the State of Ohio.

PROFESSOR E. B. HOLT, assistant professor of psychology at Harvard University, has tendered his resignation to take effect September 1, 1918.

THE psychological laboratory at Mt. Holyoke College which was destroyed by fire during the Christmas vacation is now being accommodated in another building.

At the February meeting of the New York Branch of the American Psychological Association the following papers were read: G. Strickland, *The Influence of Practice on Correlation of Abilities*; C. F. Chassel, *A Tentative Formulation of a Psychology of Play*; D. R. Brimhall, *Families of American Men of Science*; L. I. Stecher, *A Note on a Mathematical Prodigy*; H. L. Hollingworth, *Redintegrative Mechanisms in the Psychoneuroses*.

PROFESSOR M. E. HAGGERTY, of the University of Minnesota, has been commissioned major in the Sanitary Corps, to undertake work in connection with special hospitals and the reeducation of disabled soldiers.

THE PSYCHOLOGICAL BULLETIN

AN EXPERIMENT WITH AN AUTOMATIC MNEMONIC SYSTEM

BY DAVID SPENCE HILL

The University of Illinois

Classroom Experimentation.—It is perhaps rare that an instructor can find time and means available to utilize a good mnemonic system for purposes of classroom demonstration, and not only to prove by experiment the defects and limitations of the method but also to demonstrate the operation in consciousness of the “laws of association.”

Too often students studying psychology for the first time are prone to accept the various formulae for the laws of association as mere rules or statements to be learned, rather than as basal processes of consciousness to be demonstrated by introspection under controlled conditions.

We have found, in the course of instruction of several different classes in elementary and in educational psychology, that the use of the mnemonic device which we are about to record here has been of pedagogical value as a classroom experiment. The experiment consists essentially of this procedure: Students who have been studying the general fact of association, *i. e.*, that “perceptions and ideas once welded together in consciousness tend to persist,” are told (*a*) of the illicit uses of mnemonic systems by memory-trainers and charlatans, and (*b*) that the principle of association indicated above can be strikingly demonstrated by a certain mnemonic device. They are also told (*c*) that on the next day or recitation the instructor will undertake two things: (1) He will repeat in any consecutive order required, backward or forward, or in irregular order, a list of disconnected words prepared by the students and read slowly to him *once*. (2) He will afterwards teach the students how to do the same thing, following a few minutes’ instruction. The writer has found that curiosity, interest, and considerable

reading result from the announcement, and when he does the two things promised.

We print below the system, which is based upon an adaptation of the old letter-number principle, devised by us and now printed for the first time. If the reader is sufficiently interested to read the following paragraphs attentively he will probably find that the system itself can be "memorized" almost without effort, that is, a single careful consideration of the spelling and of the visual imagery of each word of the hundred will result in his being able to name most of them in any order. This is a point of value, since many mnemonic systems are so hard to retain that they are practically useless. In using the system in order to retain another prepared list (preferably simple, concrete nouns, as: ship, iron, money, etc.) the experimenter, if he has not already mastered the mnemonic device, may hold the same written on a card before his eyes while he listens to the very slow reading of the new list to be retained.

An Automatic Mnemonic System for Retention and Recall of Isolated Words

1. Air	11. Ambrosia	21. Boa	31. Cocoa	41. Dahlia
2. Bar	12. Arab	22. Bag	32. Cab	42. Daub
3. Car	13. Alcoholic	23. Boracic	33. Comic	43. Diabetic
4. Dagger	14. Almond	24. Bed	34. Card	44. Diamond
5. Ear	15. Ape	25. Bee	35. Cane	45. Dice
6. Fur	16. Aloof	26. Beef	36. Calf	46. Dwarf
7. Gar	17. Aching	27. Bog	37. Cog	47. Dog
8. Hunger	18. Arch	28. Bunch	38. Cough	48. Dish
9. Indicator	19. Alkali	29. Biloxi	39. Cacti	49. Delphi
10. Acorn	20. Bun	30. Can	40. Dun	50. Emulsion
51. Encyclopedia	61. Fibula	71. Guava	81. Henna	91. India
52. Ebb	62. Fob	72. Grab	82. Hub	92. Istib
53. Epic	63. Franc	73. Garlic	83. Heretic	93. Ipecac
54. Ephod	64. Ford	74. Ground	84. Hand	94. Island
55. Engine	65. Face	75. Gate	85. Home	95. Imbecile
56. Elf	66. Fig-leaf	76. Golf	86. Hoof	96. Icefish
57. Egg	67. Fog	77. Gong	87. Hog	97. Icing
58. Elijah	68. Fish	78. Growth	88. Hash	98. Itch
59. Ennui	69. Fungi	79. Gobi	89. Haiti	99. Impi
60. Fan	70. Gun	80. Hen	90. Iron	100. Ann

[Notes: Biloxi (29) = Gulf town in U. S.; Istib (92) = Turkish village; Impi (99) = African savage.]

How to Master Easily the Mnemonic System.—The two cardinal prerequisites for the use of the device are: (a) Understanding of

the principles underlying the choice and spelling of the words in the above list of mnemonics, and (b) insistence upon forming at the outset a vivid, clear image (if possible visual) of the thing represented by each word of the mnemonic series.

(a) *How the permanent list of mnemonics is formed.*—Notice the nine digits, respectively, 1, 2, 3, 4, 5, 6, 7, 8 and 9, correspond to the first nine letters of the alphabet, each of which letters in consecutive order marks the first letter in each of the first nine words. *I. e.*, a = 1 (air); b = 2 (bar); c = 3 (car); d = 4 (dagger). The last letter (r) of the first nine words has no significance, except to help identify these words—air, bar, car, etc.,—as belonging to the first nine.

Mnemonics 10, 20, 30, 40, 50, 60, 70, 80, 90 are thus formed: Let O (zero) = n. The first digit will be represented as before, a = 1, b = 2, c = 3, etc. Then we may always represent 10 by *acorn*, 20 by *bun*, 30 by *can*, 40 by *dun*, 50 by *emulsion*, 60 by *fan*, 70 by *gun*, 80 by *hen*, 90 by *iron*, 100 by *Ann*. Study each word of the series until the formation is understood, as related to the first and last letters of its spelling.

(b) *Imagery association with each word in the mnemonic list.*—To the writer, the word *air* brings up a picture of the open heavens, atmosphere, blue sky. *Bar* to him recalls a great sand bar he once saw on the seashore. *Car*, a passenger coach. *Dagger*, a silver paper cutter on the desk. *Ear*, his own right ear. *Fur*, his wife's hand muff. *Gar*, a large fish he pulled from the water, etc. Each original association is of some definite experience. Make no attempt to memorize by sheer repetition the words of the above list. It is unnecessary. In that the words of the series are recalled mechanically (according to digit and letter), the device is in a sense automatic.

(c) *List easily recalled.*—If you understand the formation of each word according to the principle of correspondence of letters and digits explained in (a), and have aroused definite, vivid imagery for each word according to (b), then any word in the list may be easily recalled. Thus, what is the 25th word? It must begin with *b* and end with *e*; it is *Bee*.

Using the Mnemonic System.—Have some one write out and number 25 or 30 unrelated words, which he is afterwards to read to you. Concrete nouns are most suitable for the demonstration, as indicated at the outset. Make the steadfast rules: (a) Each word needs be read aloud but one time, (b) do not permit a word to be

read until you say "now" or "next." That is, until you have had time in which to build a picture mentally with the correspondingly numbered mnemonic. Each word heard must arouse in the experimenter's mind a definite image and this is to be related to the permanent images already formed for the mnemonic series, *e. g.*: The reader first says *dog*. I think of my own dog, his color, size, appearance, and in order to link the ideas with mnemonic 1, I try to think vividly of this dog sniffing the air on a light cloudless day. (See (b) above). I thereupon dismiss the picture. I say "now" or "next," and the reader for his second word perhaps says *tree*. Mentally I portray a lone tree upon that sandbar (see (b)) representing mnemonic 2. The next word is *brick*. I think of a railroad car (see (b)) full of bricks, the car representing mnemonic 3. The more vivid the picture, even if it be ridiculous, the more promptly will each mental complex be recalled after the 25, 30, or more words have thus been heard and the ideas blended or associated. Few persons will thereupon have difficulty in recalling in any required order the whole list heard but once. To recall, *e. g.*, the third word, one knows that the third mnemonic begins with *c* and ends with *r*; it is car. The image of *car* brings almost inevitably the persisting image of *brick*, ideas of which have been "welded in consciousness" with ideas of *car*, and so for each of the other words. It is hardly a process of memorizing, but the results are quite startling to one who does not know that the experimenter has the mnemonic list either in his head, or upon a card conveniently before his eyes if he does not care to learn the list by processes (a) and (b) above indicated.

For classroom purposes, the instructor should act as subject upon the first day, immediately afterwards displaying upon black-board or chart the entire mnemonic system, with appropriate explanations. At the next meeting the students act as subjects, the instructor calling a list of words.

Finally, the potency of association and of vividness of impression as factors in retention and recall may be dwelt upon profitably. Since all new associations have been built upon old associations thoroughly familiar, namely, the digits and the alphabet, therefore the principle of apperception may also be illustrated. Appropriate cautions, warnings against formal mnemonics and memory trainers, and selected references for reading may be given.

Class Values.—When the nature of the course, the preparation of the students, and time, have permitted the use of our mnemonic

system we have found the following potential values in its adoption as a class experiment: (1) It demonstrates and then exposes a method by which some traveling lecturers on memory startle their audiences by seemingly difficult feats of memorization. (2) Participation and success upon the part of practically every student is obtained in class work. A student may marvel at the performance of the instructor and then he is disillusioned by being enabled to do the thing himself. A right evaluation of the mnemonic principle is made possible. (3) The process gives a cue and an impetus for the study and analysis of associative processes, laws of association, etc., by methods of introspection. (4) It is productive of interest in the possibility of modifying learning processes by means of economical methods, rather than by trial and error. It may be made a stimulus to experimentation of a serious character.

GENERAL REVIEWS AND SUMMARIES

AFFECTIVE PHENOMENA—DESCRIPTIVE AND THEORETICAL

BY H. N. GARDINER

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Wohlgemuth (7) is interested in discriminating the pain sensation from the affective qualities of feeling, and in finding for the latter, as distinct elementary processes, a neural correlate. For the distinction between pain and the feelings he adduces, along with other considerations, introspective evidence based on a research, to be published later in full, and defends the position taken against objections. As regards the neural correlate of feeling he finds that eminent psychologists inconsistently accept the principle that elementary processes of consciousness correspond to definite neurone processes and admit that the feelings are elementary, but refuse to accept the obvious conclusion. The citations do not bear him out. What is cited as supporting the major premise is not that, but for the most part the assumption of some form, often quite general, of the doctrine of psycho-physical parallelism, or correlation, and with this the nutrition, or dischargeability, theory which some of the writers hold is consistent, even if wrong. The view which the author finds probable is suggested by the investigations of Head and Holmes tending to fix the center of affection in the lateral zone of the optic thalamus. It is shown, indeed, that in the *syndrome thalamique* both pleasant and unpleasant feeling-tone may be exaggerated, even in some cases in the absence of sensation proper. But is this the only case where affectivity is modified? And even if we assume a functional disturbance in the thalamus in every such case, we hardly seem to come much nearer to a definite conception of the neural process in affection unless we know more precisely the influence exerted by the thalamus on other parts of the brain and on the brain as a whole.

Titchener (5) subjects to a thorough-going examination the affective psychology of Stumpf with reference to the author's recent *apologia*. Stumpf's doctrine rests on the distinction of emotions

and what are commonly termed sensory, or elementary, feelings, the former being, according to him, acts or functions, the latter, phenomena, namely, sensations. Titchener contends that the conception of emotion lacks clearness. Its psychological nucleus is represented as a *gemütliche Stellungnahme* based on an immanent judgment of matter-of-fact; but we have no definition of *gemütlich*. Further, in actual experience emotions are variously complicated by sensations, but although the difference between phenomenon and psychical function is said to be "the clearest-cut we know," Stumpf himself finds it difficult to decide, on occasion, whether a given experience is all function or partly phenomenon. In his doctrine of 'algedonic sensations' Stumpf groups together such heterogeneous things as cutaneous pain and the disagreeableness of asafetida and introduces into psychology a unique and hitherto unknown class of sensations. This, though not conclusive, is at least a *prima facie* objection to his theory. Stumpf's replies to his critics are then reviewed and found wanting, and the historical background which he discovers in writers of the seventeenth and eighteenth century turns out to be a dissolving view when seen in the light of Titchener's erudition. Among the motives which led Stumpf to his theory Titchener notes particularly his interest in the feelings aroused by tones. Herein lies the real strength of the theory of algedonic sensations; it enables Stumpf to cope with the recorded changes of affective reaction to tone-sensations, "and especially with those due to habitual direction of attention, to dispositions of judgment, to habits of all kinds." But if it is to make converts, we must have the fourth volume of the *Tonpsychologie*! Incidentally Titchener makes an explanation of his own terminology which will interest many. Stumpf had charged him with vacillation. Titchener says that he is consistent. He parallels, he says, *affection*, the feeling element, with sensation; *feeling*, a complex of sensory and affective processes in which affection dominates, with perception; *emotion* with thought. But in so recent a work as "A Beginner's Psychology" we find a different usage; pleasant and unpleasant, the elementary processes, are designated *simple feelings* (p. 79), from which the blends of these with sensations are distinguished as *sense-feelings* (p. 81), under which term are included along with agreeable and disagreeable the other Wundtian "dimensions." The terminology is confusing.

Watson and Morgan (6), writing down all attempted descriptions and theories of emotions as felt experiences, show how they

may be treated as forms of behavior. They find only three fundamental emotional reactions in infants, reactions which, with some hesitation, they call fear, rage and love (=, approximately, Freud's sex), but which might equally well be called X, Y and Z, the important thing being that they are definitely describable in terms of response to situations which can also be described. It is suggested that all other emotional responses may possibly be derived from these three by what the Freudians call *Uebertragung*, for which the terms "attachment" and "detachment" are proposed, the essence of the conception being habit-formation. The authors claim to have presented evidence to show "(1) that by the method of conditioned reflexes emotional reactions can be called out by situations (stimuli) which do not at first call them out; and (2) that emotions, by virtue of the secretions that are present, furnish a 'drive' (possibility of reaction or continuance of the reaction) which is lacking in ordinary instinctive and habitual actions." These assumptions suggest experimentation. The writers tell us that they have already begun the following experiment: by means of a heliostat to flash a beam of light suddenly on the face of an infant lying face upward on a table in the dark; simultaneously with the flash a sound resembling thunder is made. The object is to see whether the flash of light will in time come to produce the cry called forth by the noise. From the remark made previously that thunder and lightning, occurring nearly simultaneously, afford the most suitable conditions for arousing a conditioned reflex, it seems to be suggested that the experiment might prove the origin of the fear of lightning; if so, the introspective psychologist and the student of folklore can only wonder at the naïveté of the assumption. The article indicates in conclusion certain ways in which, in the opinion of the writers, the results of such experiments might be utilized in business and education.

Mit Worten lässt sich trefflich streiten.—James, taking the common-sense view of emotion as a felt experience and regarding as "expression" the total somatic response to the stimulus, developed the theory, opposed to common-sense, that the former was aroused by the latter. Carr (1) seeks to mediate between this theory and the older view. He proceeds by a new set of definitions. Discarding the subjective point of view in psychology and with it James's "psychophysical dichotomy," he regards the emotion and its expression as functional activities of the organism "irrespective of the fact whether they do or do not contain a conscious compo-

nent." He distinguishes in the psychophysical process in question three part-processes, the act, the emotion, and incidental by-products of the emotion. The act includes such things as the fighting activities in anger, flight in fear; the incidental by-products are such things as the trembling in anger and certain digestive and nutritive disturbances due to the vasomotor shift. The emotion he defines as "all those prior and accompanying organic processes whose function it is to render the act more efficient." He bases this view on Cannon, as Watson and Morgan did theirs of the "drive." Emotion, then, is related to act as cause to effect. It is similarly related to expression, which means, as commonly understood, the manifestation of the emotion to an outside observer, apparently its superficial manifestation. It is plain that, if we mean these things by our terms, we get a different view from that of James, but do not meet his problem, and that, in certain respect, we are equally removed from common-sense.

Henry (2), writing on the training of the emotions, makes good use of the considered opinions of such reputable psychologists as Thorndike, Pillsbury, Colvin and Bagley, and concludes, with reference to the sublimation of the Freudians, "that an effective mode of emotional control lies in the formation of attitudes, ideals and sentiments, by attaching appropriate ideas to the original emotion as a core."

According to Rignano (4) every state of attention is formed by an affective contrast, due to the fact that a given primary affectivity awakened by a distance sense and tending to set up movements adapted to its satisfaction is opposed by a secondary activity excited by the primary in consequence of some disagreeable effect arising from the prompt and complete execution of these movements. To this affective contrast is due the double or multiple points of view under which the object of attention is observed, and the greater precision and justice in the "perception" of the object. An illustration is the behavior of Ll. Morgan's chicks with the orange-peel. The discussion implies a restricted use of the term "attention," as appears from the reference to Othello and the monomaniacs; these give no real attention (*vérietable attention*), it is said, to the matters relating to their passions or ideas, and are accordingly predisposed to all sorts of autosuggestions and hallucinations. The theory takes no account of primary attention as awareness characterized by vividness and centrality. As regards consciousness, the thesis is maintained, with reference to well-known auto-

matisms, that it is not an intrinsic or absolute property of psychic states, but extrinsic and relative, one which accompanies certain modalities of reference, affective in nature, which these psychic states have among themselves. Some of the evidence adduced in support of this view seems capable of a different interpretation. Is it, for instance, so certain that, if we forget and are unable to recall something we are accustomed to do, such as putting away papers, winding the clock, putting out the gas, we must have done the act, as the author maintains, *unconsciously*?

The interesting study of courage from the French battle-front by Huot and Voivenel (3) has been made the subject of a special notice in a previous number of the BULLETIN.

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ATTENTION AND INTEREST

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Much of the work of the last year has dealt with the effects of distraction. The long work of Morgan (5) although published last year was not noticed then. Morgan's experiments consisted in a study of the incidental movements during distraction as well as of distraction itself. In essence his method was to have a subject carry on choice reactions of a complicated character with and without distractions and at the same time to record the pressure he exerted upon the key and his respiratory movements. The results were that distraction produced in thirteen of twenty-one subjects a diminution in capacity at first, followed in all but four by an in-

crease during the distraction, and eleven show a loss in efficiency after the distraction ceased. The incidental movements showed that the increased capacity was a result of greatly increased effort. During distraction the key was pressed with greater force, and in many cases the individual seemed to hold himself to his task by making slight movements of vocalization. In a second article Morgan (6) suggests that the reaction under a distraction might be used to detect individuals who are likely to break down under strain. Dallenbach (3) objects to certain statements made by Morgan of his work. Cassel and Dallenbach (2) test the effect of auditory distraction upon simple reaction time and find that the effect of distraction not only varies from subject to subject but also in the same individual from series to series. Intermittent distractions are more effective than continuous. Whether the distraction is to facilitate or to inhibit the reaction depends upon the attitude of the reagent. The passive attitude is conducive to a constant sensory reaction of normal length: the active attitude to a slow and variable reaction. Comparison of this report with Morgan's indicates that new work is necessary to determine all the laws of distraction. McQueen (4) reports an exhaustive study of the distribution of attention with particular reference to the question whether there are different types of individual, the concentrative and the distributive. His method was to determine the coefficients of correlation of distribution when different tasks are carried on together for forty children and upon a number of trained psychologists. Attention was divided between tapping and adding, sorting cards and counting by threes, putting discs on a needle by touch, comparing two circles and comparing four circles during a tachistoscopic exposure, and dotting circles with both hands on a band of paper moving behind a slit. The results indicate that there is no correlation between ability to distribute attention in one task and in another. The correlations were all low. After elimination for correlation between the tasks performed separately, the average correlation for distribution was .04. Study of displacement of ranks confirmed the conclusion. That the capacity to distribute is specific is evident, too, from the fact that there was slight correlation between capacity for making dots with right and left hands and that this varied when the band moved at different rates. In the tachistoscopic comparison of circles, observation showed the specific element to be the persistence of the image, primary memory. There was little correlation between success in distribution and teacher's

estimate of general intelligence. The correlation was greatest for tests that required considerable concentration and was negative for the motor tests. While there is no general factor of distribution the author insists that there is a unit factor of general intelligence. The author finds evidence in the introspections for the action of the four possible forms of distribution, (1) alternation, (2) one becoming automatic, and (3) psychical fusion (two acts were combined in a single rhythm), and (4) simultaneous attention to the two tasks as separate. The author does not give his absolute results but only the correlations. Titchener (8) gives a discussion of and answer to Britz's thesis in which the concept of clearness as an attribute is called into question. Titchener (8) shows that Britz is misled in his discussion of Wundt by not considering the historical development of Wundt's position. Britz's statement of Titchener's own position is inaccurate since it is based only upon the *Text-book* and a review of the *Feeling and Attention*. Titchener gives a clear restatement of the main points of his doctrine of clearness that will be valuable for ready reference. Valentine (10) makes a brief for the independence of volitional attention and for the possibility of training it. He argues first that Titchener is wrong in restricting volitional attention to action of alternative forces. In addition we must assume antecedent general tendencies. Frequent use of these tendencies may establish a habit and hence train attention. In bright children at least it is possible to develop a habit of attending to the inherently uninteresting as a means of attaining an interesting end and this may transfer. The argument is largely formal. Rignano (7) extends his theory of the dominance of affective elements to an explanation of attention. Attention occurs only when the object presented tends to arouse both pleasure and displeasure. Lloyd Morgan's chick attended only when pleasure from yolk and displeasure from caterpillar were struggling for mastery. The scientist is interested only in those facts that may either support or overthrow his theory. Consciousness as a whole is present only when present fuses with the past. It is not due to a state itself but to a relation. Here, too, affection must be present, but in this case the affective qualities agree. *Attention = contraste affectif; conscience = rapport affectif*. Thorndike (9) discovers a close correlation between the early interests of school children and their later interests and success in different subjects. The lowest correlation between early interests and later interests was 69, and the correlation between early interests and success in the upper three

grades of the elementary schools, in the high school and in college was .89 in each case.

Curtis and Foster (1) show by Meads' tachistoscopic method of determining clearness from the number of times an object first attracts attention that size was without influence upon attention. Where both size and intensity were varied intensity alone produced demonstrable effect.

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TIME AND RHYTHM

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Recent work on time and rhythm is fairly well distributed among the various fields of art and science concerned. Literature, music and zoölogy, in addition to psychology, are each represented.

The book by Patterson on the rhythm of prose (II) has attracted considerable attention in the literary journals. It is based on numerous psychological tests designed to determine individual differences with respect to the "sense of rhythm." Of all the tests, the most fundamental, as regards the theories to which the main body of the book is devoted, is the "phonograph test." For this test, five records were made by having a musically trained person

tap upon a small metal drum to the syllables or notes of three short passages of prose, one of music, and one of words arranged in haphazard order. These series of taps were then phonographically reproduced before a number of subjects, each of whom was asked to grade the series in various ways designed so as to determine his ability to organize the series of taps into a rhythmic series. It was found that some subjects succeeded much better than others. One declared that all five records gave him the impression of regular musical themes. Such an individual is termed a "timer," and is said to possess an "aggressive time-sense." He is one who has the ability to fit into an "elastic" subjective rhythm a series of syllables which in itself fails to coincide with this rhythm. Such a process of fitting-in is termed syncopation; and it is syncopation which is put forward as the experience that chiefly characterizes prose rhythm. In verse, the objective and subjective rhythms coincide; the rhythm is "coincident"; in prose, they do not; the rhythm is "syncopated."

Several short discussions of rhythm in its musical aspects appear in the *Musician* (3, 4, 12, 13). Seashore and Mount (16) publish the correlations between certain time-sense tests and the numerous other tests that have been employed at Iowa in the diagnosis of musical ability.

The biologists have indulged in a discussion of the synchronous flashing of fire-flies (1, 7, 9, 10), while Allard, in addition to comments on this subject, has described remarkable cases of synchronous chirping on the part of certain crickets (2). There may be no noticeable synchronism in the chirping at first, but if certain "nocturnal, atmospheric" conditions are right, the crickets gradually build up a synchronic rhythm, producing an effect like "waves of solemn music."

In the field of pure psychology, there appears an introspective study of visual rhythm by Ruckmich (14). He confirms the conclusion of previous investigators that visual rhythm is a possibility, finding even a series of equally spaced flashes all of the same duration, intensity and color sometimes to produce a definite grouping experience. For the most part, the study was carried on with series of flashes which objectively showed regular variations in color hue, but none in intensity or duration. In general, rhythmical perceptions "were the rule rather than the exception." The introspective reports indicate that the grouping effect "can be carried almost, if not entirely, in visual terms, *i. e.*, without the influence of such additional aids as kinaesthetic sensation." Many of the phenomena

which accompany other kinds of rhythm were noted. These include the over- and under-estimation of intervals and illusions of duration and intensity. These phenomena were variable, the most uniform being the illusory lengthening of intervals between groups.

In a bibliography of rhythm (15), Ruckmich supplies 115 titles. This supplements and brings to date his original list of 344 titles, and his first supplementary list of 66 titles.

Another study of visual rhythm, which seems only recently to have acquired publicity, though completed in 1910, is that by Weidensall (17). This study resembles the later one of Ruckmich in that it is largely introspective and contains a number of the same findings. Lights showing considerable movement were found to be much less favorable to a sense of rhythm than still lights. With still lights, there occurred abundant instances of both subjective and objective rhythm, "all very like those of auditory rhythm in complexity, in definiteness, and characteristics." In addition to the introspective observations, some experiments were made on the ability of the subjects to reproduce the temporal relations of the light series by movements of the hand, head, lips or foot.

Boring and Boring (5) deal with the accuracy of the estimates of the time of night by subjects just awakened from sleep, and with the conscious cues to these estimates so far as the subjects can tell them. In general, the errors tended to be greatest when the awakening occurred about the third hour of sleep. The most frequent cues, the designation of which all the observers found difficult, were those which depended upon the general bodily state, such as feelings of fatigue or restedness, sleepiness, "bladder-sensations," etc.

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CORRELATION

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The Evaluation of Tests.—The problem of measuring the diagnostic value of tests by correlation has come very clearly to the front through the contributions of Ruml. Following his paper of last year on the measurement of the efficiency of mental tests he has deduced what he terms the "rank-tangential coefficient" (33). He proposes using the new coefficient for measuring the value of tests for selecting any portion of a group in order of rank. As a corollary to this, the rank-tangential coefficient gives a measure for determining what portion of a group can best be selected by a given test. This measure may often be more important in practical situations than the correlation coefficient which is the basis of determining only the slant of the smoothed regression line. Ruml shows from the results of tests on three different groups of college freshmen that the tests may be decidedly more valuable for selecting, within the class, groups of similar mental ability than for predicting relative standing within these groups. For two freshmen classes the series of tests which showed a product-moment correlation of about .65 with teachers' estimates gave rank-tangential coefficients of over .90 for selecting the lowest 10 per cent. of the freshmen.

The rank-tangential coefficient is deduced from Pearson's bi-serial r , which Ruml suggests calling a tangential coefficient (T) instead of a correlation coefficient, since it is equal to r only under certain conditions, although it is equivalent in meaning and varies from $+1$ to -1 . The rank-tangential coefficient, " t ," is easily computed and expresses "the ratio of the mean value of X devia-

tions in rank associated with a Y array, to the mean deviation of that Y array." In using the rank-tangential coefficient, it should be remembered that units of rank are treated as equal and the measure of relationship is for resemblance in ranks rather than for resemblance in other measures of ability.

In another paper, Ruml (32) raises a second important objection to regarding the correlation coefficient as always the best indication of the diagnostic value of a test. He plots the relation between the coefficient of correlation and the standard error of prediction of x from y . The increase in the error of prediction is very rapid with the decrease in the size of the coefficient; so rapid, in fact, that when a correlation is as low as .50 the error of prediction is $7/8$ of its maximum size. Instead of using r , Ruml, therefore, proposes using the error of estimate as a measure of the diagnostic value of a test.

Rosenow (30), for the first time in psychological work, calls attention to an important characteristic of the multiple correlation coefficient, which suggests a minimum value below which it may have little value even when it is large compared with its own error. He uses Yule's approximation formula to discover how large the coefficient might be owing to the fluctuations of sampling among wholly uncorrelated variables, on account of the fact that the errors do not neutralize each other but are cumulative. Thus, in his study of the multiple correlation between the class standing and 15 tests from 92 cases a multiple correlation coefficient of .40 might arise from variables which were not related at all. The actual coefficient found, .55, when all 15 tests were properly weighted, therefore had little value. On the other hand, with the five best tests a multiple coefficient of .52 is quite significant compared with the value .21 which might be obtained by chance.

The theory underlying Hardwick's method (14) for a new approximation to the best weighting in points to be given for each of the 20 tests in the Yerkes-Bridges-Hardwick Point Scale is hardly justified statistically. It is, however, perhaps better than the common practice of giving a person a summated score from a series of tests without weighting them at all. She assumes that "the tests would be correctly weighted if their scores were proportioned to their respective correlations with general intelligence." She then proceeds to find the average correlation for each test for three groups, 6-year-olds, 9-year-olds, and 12- and 13-year-olds between that test and the total point score for the individuals. The best weighting could only be obtained by partial correlation.

It is essential that allowance be made for the intercorrelations of the tests. Giving the same individual time after time credit in points for the same sort of tested ability tends to lessen the prediction value of the combined score. It decreases the value which the supplementary abilities would have in the total prediction. Rosenow (30) discusses this question at length in weighting the Kitson tests at Chicago University. Two features of the data which Hardwick presents are important, although they are not commented on by her. Five of the tests show a difference of .50 or more in the different age groups in the closeness of their correlation with the total score. Moreover, between the ranking of the tests on the basis of high correlation for the 6-year-olds and for the 12- and 13-year-old group there is a minus correlation. This suggests that a weighting for younger ages probably would not hold for older ages. High correlations with general intelligence often indicate a wider scatter of the test scores; but not theoretically, as she assumes, a nearer approach to a normal distribution of scores.

Method.—Rugg's chapter on correlation (31) presents in 75 pages for the non-mathematical reader the best simple treatment of the measurement of relationship. Schoolmen will especially appreciate his success in explaining the reasons for the principal devices and their significance without expressing the explanation in technical language. The methods of computing the various coefficients are also presented simply and fully. Unfortunately, space forbade his including partial correlation which illuminates the whole subject of analysis of causes. It will probably be the most important feature of the work in correlation during the next decade. An admirable illustration is given of the non-linear relation of cost-per-student-instructed and number of pupils instructed by one teacher. Diagram 43 would be simpler and more in accord with Galton's presentation in his *Natural Inheritance* if the line which measures the proportion of perfect correlation extended from the diagonal of perfect correlation across the regression line perpendicular to the mean X axis.

Otis (26) has shown how to find the relative weighting of two variables for predicting a third without calculating any of the partial correlation coefficients. The method saves about half the calculations of the usual partial regression equation and is useful when the errors of the prediction are not required. He also provides the corresponding formula for more than three variables, which reduces the number of partial coefficients to be calculated. Rosenow (30)

contributes a scheme for the mechanical technique of calculating partial coefficients which may reduce the labor of calculation as much as half, when only the relation to one dependent variable is required as is common in psychological work.

The normal probability table does not apply accurately to the probable errors of coefficients of correlation calculated from small samples. An elaborate co-operative study (35) now makes available further tables for estimating the skewed distribution surfaces of the correlations for small samples. These surfaces are all forms from a rectangle to J and U forms, but in general it may be said that the distributions of the correlations in small samples tend to have modes above the true correlations and means below the true correlations. For example, with a true correlation of .50 in the population sampled, the modal correlation expected, when calculated from samples of 10 cases, would be .63 and the expected mean of the correlations in such samples, .48. Pearson (27) provides the tables for determining the error of the correlation coefficient calculated by his biserial η , when one variable is given in alternative categories and the other by multiple categories. Lee (18) completes Everitt's work by providing the supplementary tables for calculating correlations above plus or minus .80 by the tetrachoric method in certain cases not previously covered. We may expect more and more use of this method with social material in which the data can often be divided only into two groups.

Analysis of Abilities.—The use of correlation for unraveling the factors involved in various abilities continues to be fruitful. In this connection, the study of special abilities is suggestive. Seashore and Mount (34) give an elaborate analysis of the relations of tested musical talent to musical training, environment, the enjoyment of music, and musical accomplishment. The low correlations indicate that training is commonly given with little regard to talent. Stevenson (36) finds that intercorrelations of discrimination of sounds, lines and brightnesses, when accurately measured, bring out close relationships (.90 plus) in sense discrimination. With pressure, accurate tests were not possible and the correlation was less. In a penetrating study Downey (9) shows the possibility of the degree of unidexterity being indicative of specialized capacity which may be of value in some forms of spatial orientation. It is related to mirror-reading and, perhaps, to visualization. Gordon (11) does not find that unidexterity goes with either strength of grip or maturity. The correlations between abilities in the four

fundamental operations in arithmetic are from .46 to .75. McQueen (21) by a very complete statistical treatment, including partial correlation to eliminate the effect of certain factors, finds that there is no evidence of a general power of distribution of the attention. Bickersteth (2) also gives negative evidence for common factors. The small correlations between tests for divided and sustained attention give no support for the idea of one capacity of attention. Rosenow (30) illustrates with Kitson's test data on Chicago University students what may be done by correlation analysis of mental functions. Bennet (1) found auditory and visual presentation with disconnected materials had more in common than with connected materials, and that ability in mediate retention has more in common with different materials than ability for immediate recall. Gordon (12) shows an independence of memory for nonsense syllables and rapid learning of music. Dearborn and Brewer (7) give the relations of a class experiment in learning a code to tests of memory. Buckingham (5) finds correlations of about .4 between tests for ability to think about and ability to remember facts in history.

In Business Psychology.—Hollingworth and Poffenberger (15) give the correlations between tests and success in 11 occupations; Burt (6) gives them for the Münsterberg vocational tests; Rogers (29) for stenographers and typewriters. The latter found that the empirical selection of tests would give "a far more reliable criterion for vocational guidance in the field of stenography than has ever been attained by any other method." Moody (24) gives the correlation between salaries of teachers and their academic grades. Marks in the theory and practice of teaching are no better than average scholarship. Inspection of the tables shows closer relations with low marks and low salaries. The highest coefficient found with salaries was .52. A method of estimating various personal traits for the use of the employment bureau at the Carnegie Institute of Technology is evaluated by Miner (22). Estimates of leadership are least indicated by grades. Gould (13) shows that a test for memory of names and faces agrees .75 with the empirical test of this ability among 10 psychologists when trying to remember a group of 17 students after brief introductions.

Mental Development.—Correlation was used extensively by Bickersteth (2) in his study of the variations of tested abilities with maturity. The same 12 tests were given to children of different ages. He thinks that the tests reached capacity because they

showed small correlations with life-age, when children were in the same grades and were from 9 to 11 in age. There is small relation between mental and motor ability and it decreases with age, while the interrelations of the tests of higher mental traits increase with age. In an important comparison between normal and feeble-minded children of the same mental ages, Woodrow (39) concludes that there is an absence of correlation between capacity to learn and capacity to grow mentally. The correlations for absolute and for relative gain with practice in a form sorting test for the normal and for the feeble-minded group were negative with initial ability in the test. Those for percentage of improvement were practically three times their P. E.'s. This is only apparently contrary to the usual results in which those who are best in a test improve most with subsequent practice since here differences in mental age were almost eliminated. Following Woodrow's argument we might suppose that greater mental ability, even greater mental maturity; but not greater capacity for mental growth (capacity to increase mental age) may go with rapid learning. "The connection between language differences and intelligence differences becomes more intimate with increasing years," so Brigham found (4). Terman *et al.* (38) found that the correlation between I Q's obtained with the Stanford Scale and teacher's estimates of intelligence increased from .48 to .71 when the effects of extraneous factors upon the estimates were eliminated. Doll (8) shows that the results with his two brief Binet scales correlate over .90 with the complete mental age ratings for either normal or feeble-minded children. The ratio of actual to expected school grade, Pedagogical Quotient, correlates .82 with the I Q's of school children. Race (28) gives the correlations of I Q's with various tests. The opposites test is closest related and Courtis' Arithmetic test only .09.

School Records.—Besides the studies of Ruml (32) and Rosenow (30), there are numerous correlations with school work. The closest relation for a series of tests and school grades was at the Whitewater Normal where James (16) found that the average record from his series of five tests correlated .55 to .63 with different school subjects. Bright students not studying and dull students studying hard reduce the correlations. Gordon (11) found a correlation of .77 between a mechanical syllogism test and college grades. King and M'Crory (17) give correlations for 276 women and 268 men in the freshman class of the College of Liberal Arts at Iowa University. The intercorrelations of the tests are also given, but

the authors do not combine them in a multiple coefficient. The differences between the correlations with university grades for men and for women, especially with the opposites test, .84 and .45 respectively, suggest that the male group is more varied in ability. It is important to remember that the size of the coefficient increases decidedly with increase in the extent of scatter of the group. This may account also in part for the low correlations of tests with class averages found by Sunne (37) and also for those by Garrison (10) who used scores in the Point Scale. The tests often do not sufficiently discriminate those of best ability. Minnick (23) finds that four tests for different types of ability in geometry show widely different correlations in different schools. How much this result is influenced by differences in the native variability of pupils in the different geometry classes and how much is due to difference in methods of teaching is an important educational problem. Coefficients of .55 or over were found for each test in some school. Myers (25) found that in delayed recall students remembered best the names of the military men most frequently mentioned in histories, but that this was not true for names of prominent civilians. Breed (3) found that Starch's method of testing the comprehension of reading does not measure the same factors as Thorndike's. McCall and Ruger (20) demonstrate that a study of the correlation of psychological and educational measurements was closely duplicated by a similar study a year later. Lincoln (19) finds that high school marks correlate better with college marks than do entrance examinations.

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SPECIAL REVIEWS

The Self and Nature. DEWITT H. PARKER. Cambridge: Harvard University, 1917. Pp. vi + 316.

The writer of this notice would like to deduce from the fact that DeWitt H. Parker's book on *The Self and Nature* was sent for review to the PSYCHOLOGICAL BULLETIN the hopeful conclusion that publishers at any rate recognize that psychology has to do with selves. She must however admit that, in this case, the title has proved misleading. The truth is that self and nature, mind and body, may be either scientifically treated—accepted without challenge of their ultimate reality for analysis at the hands of the scientists—or may be treated from the metaphysician's standpoint. Professor Parker's book is the embodiment of a philosophical system; it sets forth an independent and vigorous idealism with Berkeley's and with Bergson's, though identical with neither. Mr. Parker "finds it reasonable to interpret the processes of the external world after the analogy of the inner world" (p. 143.) He says truly (p. VI.) that: "The source of all our knowledge of reality is given experience—without a careful analysis of this there can be no sound metaphysics." It follows, of course, that the philosophy of self or mind is rooted in psychology; and there is accordingly no cause for surprise in the fact that more than one chapter of the book is fruitful in suggestion to psychologists. This is notably true of Chapter II. in which Mr. Parker asserts as facts of experience both the identity and the changing nature of the self. "Permanence and change," he says, (p. 50¹) "adventurous seeking for the new and a tragic holding on to the old or effort to escape the old; self-making and self-mending—such is the life of the mind. Throughout there is the thread of identity; the old man remains in some respects the same as the child. Yet the amount of this identity varies on different occasions. It is great when a man puts all his emotional energy into some task which requires the use of his whole past experience, the total resources of his memory and learning; then, as we say, he is most himself; it is little when in a light moment of gaiety, he forgets himself, feeding on new impressions."

Professor Parker sharply and successfully contrasts the "idea" or "concept" or "thought" of identity with the immediate "feeling"

of it. "The abstract concept of identity," he says (p. 41³), "like all concepts, is the reflex or representative in the mind of something real in that which the mind knows and reflects upon. The application of a concept to anything is the assertion that there exists in the thing a reality corresponding to the concept, known by the concept. . . . Personal identity, is however (p. 51²), no more identical with self identification than blue is with the concept of blue. When we waken in the morning we feel ourselves to be the same without any over assimilation of the new experience to the idea of ourselves; the idea may not arise at all. There are times when the idea of self is in abeyance, as when we work quietly; yet there is a sense of familiarity which pervades all experience and is the abiding identity within it." A second point which is stressed is the fact that the feeling of personal identity persists during great disturbances of *cœnæsthesia* and of memory. "Personal identity," Parker says, "can be more or less. . . . From birth to death there is a continual acquisition of new experiences; a partial preservation of these through the residua of memory; a re-emergence of old activities; the loss again of these; the irreparable loss of some" (p. 50¹). We usually," he adds, "call a man another man when he fails to recognize himself—when he applies to his experience a different concept of self from the one which we have been accustomed to (p. 50²). . . . Yet identity may exist here as elsewhere. . . . Experience may in some measure be familiar still."

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Applied Psychology. H. L. HOLLINGWORTH & A. T. POFFENBERGER.
New York: Appleton, 1917. Pp. 337.

This book is the first attempt in English to cover in one volume the entire field of applied psychology. Such an attempt, especially in a volume of medium size, must needs be cursory, but the authors are content "if it assists in systematizing" the field,—which it certainly does. According to the preface the work is intended alike for teacher, student and the general reader. It might very well serve as a nucleus on which to build a course in applied psychology and it is sufficiently non-technical to be understood by the business or professional man who is interested in the subject.

The first chapter touches upon the modern behavioristic trend, pointing out that in practical situations it is behavior (in the broad sense) which is of importance. Exception is taken to Münsterberg's

separation of applied psychology from psychotechnics but there is agreement with his other proposition that applied psychology should deal with means and not ends. Then follow a few pages on the history of applied psychology and its relation to efficiency. Finally the fundamental fact is emphasized that applied psychology must "rest upon a knowledge of the laws of individual behavior."

After this introductory chapter the first half of the book is devoted to factors which affect the personality and efficiency of the individual. The latter half considers specific human purposes,—business, law, medicine, etc.

Heredity is discussed from three standpoints,—species, race and family. The first of these includes a catalogue of some reflexes and instincts and other characteristics such as sensation, attention and memory. Under the second there is mention of Woodworth's form-board studies of different races and a study of school marks of negro vs. white children. It is doubtful whether this chapter (II) adds much to the book aside from making it appear more systematic. However the topical arrangement here, as elsewhere, is very commendable. Under family inheritance mention is made of the statistical studies of Galton, Thorndike's study of sibs and twins, Goddard's *Kallikak Family* and others. The eugenic implications of the facts are emphasized and the present legal status of the control of marriage and procreation in defective cases is described.

In the chapter on "Efficiency and Learning" the salient facts concerning the acquisition of skill are outlined. One point not always mentioned in such discussions is brought out, viz., the incentive of competing with one's own record. Then follows a good summary of economy of memory, the unimportance of imagery for learning and typical results showing lack of transfer of training and the reduction of variability by practice. The chapter is one of the best in the book.

We now turn to differences due to sex and age. The overlapping of the two sexes in mental traits, measured and estimated, is clearly shown by tables and examples and data is presented controverting the familiar claim of greater variability in the male sex. Curves are given for results of mental and physical tests at different ages and the importance of mental vs. chronological age is emphasized.

Two chapters are devoted to "Environmental Conditions." The results of the New York Ventilation Commission are drawn upon to show that the paramount questions in ventilation as affecting mental efficiency are temperature and humidity rather than

oxygen and carbon dioxide. Climatic and weather influences are reduced to these same two factors. Diurnal rhythms in mental and motor processes are discussed, showing maximum mental efficiency in the forenoon and maximum motor in the afternoon. Ferree's work on illumination is summarized,—the desirability of uniform illumination, unglazed paper and opaque eyeshades lined with white, etc., because of the peripheral sensitivity of the retina to glare and the impulses to turn or accommodate the eyes. The effect of distractions in sometimes using up additional energy even if the distraction is overcome is noted. The effect of monotony is shown to be a question of incentive and interest rather than environment.

Chapter VIII discusses work, fatigue, rest and sleep,—the difficulty of finding any adequate measure of fatigue; the importance of determining the proper rest periods; and the difference in the amount of sleep required by different individuals.

The next chapter deals with drugs and stimulants. This includes Bush's study of decrease in mental efficiency after tobacco smoking, with the greatest effect in imagery, perception and association; Dodge and Benedict's finding of a reduction in reflex and sensory processes after alcohol; the effects of alcohol on learning in rats; the correlation of alcoholism with feeble-mindedness; Hollingworth's study of caffeine and Poffenberger's of strychnine.

The remainder of the book is devoted to the application of psychology to special fields. This may be done in three ways: (1) applying the psychological attitude,—analysis,—an attitude not so characteristic of the other sciences; (2) applying psychological knowledge,—the findings of modern experimental psychology; (3) applying psychological technique,—the methods of the psychological laboratory.

"Psychology and the Executive" deals first with the selection of employees by mental tests and lists tests used by various investigators in a dozen vocations and the correlation coefficients of such tests with vocational ability. There is no mention of the theory of partial correlations which will probably afford the most striking progress in this field in future. Then there is mention of functionalizing in industry, measurement of performance by psychological technique, absence of any instinct for workmanship in the practical situation, standardizing work to fit the habits of the worker, the use of published records of performance and a workman's competition with his own record, environmental factors

already alluded to and dynamogenic factors such as rhythm. Much of the chapter is rather general. Some of the points might well be elaborated more specifically.

"Psychology in the Workshop" includes the undesirability of shifting the mental set in a mixed series of operations (for example, dishwashing); the distribution of work from the standpoint of fatigue (pig iron handlers); routing the path of movement; and motion study such as Gilbreth's.

"Psychology and the Market" takes up the question of trademark infringement as studied in recognition experiments; a general outline of the possibilities in the psychology of advertising (but only an outline); and a few pages on salesmanship.

Under "Psychology and the Law" we have as methods of accumulating evidence the association reaction experiment and expressive methods (breathing) to detect falsehood. In evaluating testimony comes the suggestive effect of variously worded questions. In connection with determining of responsibility are the facts of prevalence of mental defect among criminals. Finally an experiment is described in which individuals ranked the deterrent effect of a series of sentences varying from life imprisonment with almost absolute certainty of escape to ten days imprisonment with almost absolute certainty of punishment. There seem to be some individuals for whom the certainty and others for whom the penalty is the deterrent factor.

In "Psychology and the Social Worker" the prevalence of mental defect is shown in unemployment and delinquency and the normal distribution curve is mentioned.

Medicine may profit from psychological tests on patients to determine deviation from the normal or to check the efficacy of some treatment. Researches on the effect of drugs are of value to medicine. The importance of control doses and control squads in such experiments is duly emphasized. Psychoanalysis is alluded to with a final injunction that "the therapeutic success of a technique in no way constitutes a proof of such speculations as the practitioner may incidentally indulge in." The negative findings of Mrs. Hollingworth as to the mental effects of periodicity in women are noted. The advantages of the psychological clinic are pointed out. Finally it is suggested that training in experimental psychology would be valuable for medical students.

In relation to education we have the psychological attitude of analysis, for example, breaking up a given learning process into its

elements. The content of psychology is applied in all the laws of learning, memory, attention etc. and also in the differentiation of normal from abnormal. The psychological technique is applied in actual school-room experiments upon distribution of practice and the like and in the development of scales for special functions.

The final chapter deals with the future of applied psychology. The present means by which practical problems are being approached are far from satisfactory. Professional jealousy between physician and psychologist in the clinic, the acquiring of a smattering of psychology by the business man or the acquiring of a business knowledge by the psychologist while pursuing academic work are all undesirable. The immediate solution will be the placing of psychological experts in the factory, school, court, etc., and later will come the need for the engineering type of psychotechnic expert, —the consulting psychologist.

It is unfortunate that books of this sort have to be written with a view to the public as well as the psychologist. In writing for the layman considerable space must be devoted to matters that are almost trivial to the psychologist and in some instances generalities must be used to conceal the scarcity of psychological knowledge on a special topic. The student would gladly face the facts and would appreciate a fuller exposition of the topics which have been more thoroughly worked. One cannot help imagining a similar book (perhaps in two volumes) which takes for granted the fundamentals of psychology, presents specifically our scanty knowledge on certain topics without attempting to magnify that knowledge, treats other topics as systematically as in the present case but in considerably more detail and includes references to the principal studies and monographs utilized in the discussion.

The arrangement of the book is excellent and it would form a systematic outline for courses in the subject. It will undoubtedly be used as the basis of the majority of such courses for some time to come. The topical treatment in parts that are briefly summarized is very commendable. Considerable data is included that had been published since Münsterberg's *Psychotechnik* appeared in 1914.

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REPORT

COURSES IN PSYCHOLOGY FOR THE STUDENTS' ARMY TRAINING CORPS

Late in August, Major Yerkes, Chairman of the Committee on Psychology of the National Research Council, received information from the chairman of the Section on Relations with Educational Institutions that Psychology was to be listed as an allied subject by the Committee of the War Department on Education and Special Training. This information carried with it the suggestion that a suitable course in Psychology be prepared with especial reference to its military bearings.

After conference with members of the Committee on Education, members of the Psychology Committee of the Research Council and representatives of the American Psychological Association, a sub-committee of the Research Council was appointed; consisting of Messrs. Dodge, Baird, Strong, Terman, Thorndike and Whipple.

This Committee had the task of meeting the general policy of the Committee on Education and Special Training and of organizing the available material on the psychology of war into suitable courses for prospective officers.

Three courses are suggested. I. The Study of Human Action. II. Educational Psychology. III. The Psychology of Reasoning. It is expected that each course will occupy a quarter of twelve weeks, three recitations and six hours of study a week. But any other division of the nine hours a week may be made at the discretion of the instructor.

A monograph text book for course I is in preparation under the collaboration of Messrs. Dodge, Thorndike, Terman, Strong, Baird, Hall, Lindley and Whipple. Since its preparation and publication is sure to be delayed several weeks, all practicable data will be supplied by the Committee through the courtesy of the *PSYCHOLOGICAL BULLETIN*.

The following suggestions and recommendations with respect to the content of the three courses are submitted.

COURSE I. THE STUDY OF HUMAN ACTION

In the present war, psychology has been adapted to meet military needs in many new ways. In particular, new tasks which confronted the Army and Navy have been analyzed and means have been elaborated for finding properly qualified personnel. Methods have been developed for testing and classifying the drafted men to meet the intellectual, technical and administrative needs of the rapidly expanding Army, and to prevent those who were unfit from having improper responsibilities put upon them. Systematic rating scales have taken the place of casual opinions of the fitness of men for the duties of officers.

In the so-called "psychological offensive" of various sorts, in propaganda for morale, in camouflage and signalling, in intelligence service and military operations, psychological principles have become an increasingly obvious part of war machinery. Even the fundamental military tasks of instruction and discipline are based on well-known psychological laws.

An officer must understand not only the materials that are essential to his line of service, but he must also be taught to understand the human factors with which he has to deal. For example, it is not enough that an artillery officer should understand the operation of his gun, range finding, spotting, sight setting, the effect of atmospheric conditions, ballistics, etc.; he must also know how to organize, control and develop a competent gun crew. Unless he can do this, all the rest is useless. In no military task is the human factor absent. With the complexity of modern warfare, it is increasingly important. Failure to understand the human factor in a military situation may have disastrous consequences.

Doubtless young officers will eventually acquire more or less facility in handling men, but in the present exigency all preparation must be condensed to essentials and systematized to save time and to eliminate waste. We cannot wait for prospective officers to get the necessary information by accident or by the costly methods of trial and error.

In view of all this:

It is believed that the psychological principles which underlie established military practice as well as the principles on which the recent mental examinations and tests are based, should be brought together in a course in the study of human action for the S. A. T. C.

and made available for all prospective officers including those who will spend only one quarter in college. That is the idea of Course I.

It is consequently recommended that the elementary course in "the study of Human Action" be given in institutions which have the necessary equipment, omitting as far as possible all questions of a purely speculative or theoretical nature and concentrating on the relevant questions of applied psychology.

While it is desired to leave each instructor the greatest freedom for personal initiative, it is recommended that reading assignments, formal reports, and recitation discussions be used rather than lectures; and that wherever practicable concrete military problems should be used for illustration.

It is further recommended that in contrast to the common plan of elementary courses in psychology, the emotions and the will be emphasized instead of the intellectual processes, and that the course be applied psychology rather than systematic.

The subjects which are regarded as essential to such an elementary course in human action may be outlined under six sections.

I. The general characteristics of personal action and the conditions of effective reaction to new situations.

Difference between the reactions of a thing and the reaction of a person. Reflexes and their characteristics. Habits, their origin and importance. Voluntary action. Reaction time. The personal equation. Initiative. Practical intelligence. Estimating the situation. The mission or goal of action. Selection and choice.

II. Individual differences and their military exploitation.

The varieties, extent, measurement, and causes of individual differences. The relative influence of inheritance and experience. (Development battalions.) Intelligence tests. The classification of personnel in the Army. Trade tests. Rating scale for officers.

III. The learning process. General characteristics of habit formation. Plasticity. Fluctuation. Improvement and its limits. Fatigue.

Kinds of learning; trial and error, (laws of repetition and effect) (drill), association learning, imitation, reorganization. Laws of fatigue, saturation ("fed-up" conditions). Forgetting. Warming-up process. Individual differences in learning. Selection of men for schools. Rate of learning.

IV. Motivation and Morale.

Ideals and incentives. Interests, motives. Positive and negative incentives. Origin of ideals. Relative force of different incentives. Methods of developing and controlling ideals. Discipline. Motor outlets. Direct and indirect teaching. The military value of morale. What factors modify morale in the Army, people, workmen, enemy. Specific times of danger or fluid morale. Means used to develop morale in camp and field and among the different classes of the people. *Esprit de Corps*.

V. Principles of leadership.

Physical and mental essentials, value of knowledge, confidence, enthusiasm, reliability, resourcefulness. Crowd psychology. Principles of discipline. Methods of influencing others, command, suggestion, argument, sympathy, sternness, and softness. Traditions of conduct. Indoctrination. Prestige. Special problems of the draft.

VI. The sources and critical estimate of information. (The psychology of observation and report.)

Individual differences in sensory capacity. Utilization of persons with exceptional acuity. Individual differences in twilight vision, etc. Commoner defects and limitations. Perceptual errors. Commoner illusions that have military significance. Chief principles in camouflaging designed to prevent acquisition of information. Observation; systematic perceiving; knowing what to look for; interpreting the "senses." Training observers; its nature and possibilities. Memory (retaining and recalling what has been observed). Commoner limitations and defects of memory and recall, like omission, insertion, substitution, transposition. Verbal formulation (stating what is recalled of what was observed). Forms of report; the narrative and the questionnaire. Art of questioning; influence of suggestive questions and the like. Special problem of using quantitative terms in reports, as meters, inches, minutes, degrees, number. Effect of excitement and emotional stress generally on report. Intentional misrepresentation; lying. Military intelligence; methods, organization and training.

Considerable parts of the above course relate to material that is not readily accessible in any of the common text books. To supply this material is the purpose of the proposed series of mono-

graphs and source books. But since these are bound to be delayed, instructors may properly take up first those subjects with which they are familiar. Series of suggested questions for student reports will be issued at the earliest opportunity in the *PSYCHOLOGICAL BULLETIN*.

Aside from the familiar text books and monograph literature on systematic, physiological, educational and business psychology, attention of the instructor is called to relevant literature on crowd psychology, suggestion, business management and efficiency. Valuable reference may be made to historical, biographical and eye witness accounts of the war, and to war psychologies. Especially important from the standpoint of the present course are the psychological contributions of Army and Navy officers. It is impossible for instructors to get too thoroughly indoctrinated with the military point of view. For this purpose the following monographs will be found of especial value.

1. REAR-ADMIRAL AUSTIN M. KNIGHT, U. S. N. *The Estimate of the Situation*. U. S. Naval Institute, 1915 (April).
2. SURGEON J. F. LEYS, U. S. N. *Mental and Moral Training for War*. U. S. Naval Medical Bulletin, 1915, p. 165 (April).
3. MAJOR LEROY ELTINGE, U. S. A. *Psychology of War*. Fort Leavenworth: Army Service Schools Press, 1917.
4. CAPTAIN R. R. BELKNAP, U. S. N. *Military Character*. U. S. Naval Institute Proceedings, 1918, 44, No. 179, p. 1 (January).
5. VICE-ADMIRAL WILLIAM S. SIMMS, U. S. N. *Military Character*. Infantry Journal, 1918, 14, No. 8, p. 553 (February).
6. COLONEL APPLIN, British General Staff. *Lectures on Discipline and Training*. Washington: Army War College, 1918.
7. MAJOR C. A. BACH, U. S. A. *Leadership*. U. S. Naval Institute Proceedings, 1918, 44, No. 186, p. 1819 (August).

Material on intelligence tests in the Army, the classification of personnel, trade tests and the rating scale for officers will have the earliest possible publication. It may also be obtained by application to the personnel officers who are assigned to each S. A. T. C.

Following the general plan of the Committee on Education for providing courses for those who will be able to stay in college more than three months, the following continuation courses are suggested:

COURSE II. EDUCATIONAL PSYCHOLOGY

This course when given should be a systematic course in Educational Psychology but emphasis should be laid on the special military problems such as technical military training, the problems of personnel, mental testing and examination, the education of retarded adults and re-education of the wounded.

COURSE III. THE PSYCHOLOGY OF REASONING

This course should include perception, the concept, memory, imagination and reasoning. Under reasoning emphasis should be laid on the processes of induction and the interpretation of facts. The following topics are recommended: psychology of meaning; natural and conventional symbols. Systems of experience and their implications. The mind of an expert. Difficulty of distinguishing between observation and interpreting. Correct interpretation as the goal of thinking. Distinction between cock-sureness and critical certainty. The mind of an amateur. The collection of data. When the data are adequate. What facts are relevant. The explanation and implication of a fact. Interpretation by analogy; its popular appeal and its dangers. The analysis of data. Reference to systems of cause and effect. Systematizing fragments of information. Circumstantial evidence. The making and testing of hypotheses. Values and dangers of hypotheses. Natural law and practical certainty. The estimation of probability. Common sources of error in inference. Tradition and habit. Emotional bias and prejudice. Suggestibility. Fixed ideas and delusions. The reasoning of crowds. The fallacies.

QUESTIONS AND PROBLEMS FOR STUDY, REPORT AND CLASS ROOM DISCUSSION

These cover Section I of the elementary course in the study of human action (see p. 130).

1. The effect of mind on reaction: In what particulars would the command to take a trench affect a soldier differently from the way it would affect a lifeless thing like a log of wood? How can the presence of mind be proved? How far can one know what is in the mind of another, and by what methods? How do differences in age, race and class affect this knowledge? What are the consequent advantages of training officers first as privates?

2. Reflexes and Instincts: Describe the mechanism by which man shrinks from pain. Describe six human reflexes. How do reflexes differ from reactions to command, in mechanism, in reaction time, in voluntary control? What are instincts? In what ways do they affect adult life? Name and describe the operation of six human instincts that bear especially on the efficiency of a soldier.

3. Habits: What is the nature of habit? How much of a day's work is habit? State the personal and social advantages of habit. What is the value of drill? What are the disadvantages of habit? State the best method of eliminating undesirable habits.

4. The personal equation: What constitutes a personal equation? Do they actually exist? Why? What factors in the personal equation would you judge to be essential to make a good officer, a good scout, a good chum?

5. Coördination and Initiative: What is coördination? Describe the coördinations in writing, in shooting a flying duck. What is the nervous mechanism of coördination? What is the mechanism of coördination in an army? What is initiative? What is its military value and its danger? How can coördination and initiative be most effectively combined?

6. Voluntary action: What mental factors are found in voluntary action that are not found in reflexes and habits? If you were in a motor boat two miles from land and the boat started to leak what should be done? How would reaction to the situation be modified by the object of the trip, extent of the damage, and means of repair? What would constitute an adequate estimate of the situation? How long should deliberation last? In very important cases how can one be sure that all relevant factors are duly considered? When quickness of decision is necessary how can one prepare his reaction beforehand?

7. What advantages has an expert motor repair man over an amateur? What are your resources? What ought you to get from a military education?

THE PURPOSE OF THE QUESTIONS AND PROBLEMS

Following the general policies of the Sub-committee on Psychology, these questions like the rest of the course must be regarded by the responsible instructor merely as suggestions. They are not in any sense requirements but are printed for the convenience of those who may desire a more detailed indication of the Committee's idea of the content and method of the elementary course.

The questions are primarily planned to guide the reading of the student, by giving him specific matters to look for and to think about. They are consequently partly systematic questions to emphasize principles and partly problem questions for the application of principles.

No specific text references will be given wherever the systematic questions may be answered by the students by reference to the standard texts which should be available to them. The instructor will naturally want all his students to read some classic chapter like that of James on habit; but otherwise the discovery of the appropriate matters may well be regarded as part of the education of the student. The problem questions are not intended to be answered from texts.

[*Editorial Note:* The delay in the appearance of the BULLETIN has permitted the insertion of the foregoing report, which is much postdated as compared with the present number of the BULLETIN. The importance of the report has made this apparent anomaly of little consequence as compared with the value of immediate publication. S. I. F.]

THE
PSYCHOLOGICAL BULLETIN

THE CONDITIONS OF EFFECTIVE HUMAN ACTION¹

BY RAYMOND DODGE

Wesleyan University

I. *The Difference Between a Person and a Thing.*—If an officer should be foolish enough to command a log of wood to charge the enemy, the effect of his command would be to set up microscopic vibrations inside the log. These vibrations would die out in an infinitesimal quantity of heat that would finally radiate into space and be lost. This is a typical physical reaction. If that log had an active mind in it, with the capacity to receive impressions and to express itself in motion, a new kind of reaction would appear. The same command instead of arousing only infinitesimal vibrations will act as stimulus for a complex set of vigorous acts. Moreover, the man will act as we say intelligently. He will use complicated weapons, protect himself by available cover and coöperate with the rest of the group assigned to the same duty. In a word he will show personal initiative, skill and the capacity for training, and the ability to plan. These are characteristics of human beings. But not all human acts show initiative, skill and plan. On the contrary relatively few are on this high level.

II. *The Difference Between Reflex Action, Habit and Will.*—Choking, coughing, sneezing, cringing from pain, trembling and the like are almost as mechanical as the detonation of a cartridge when the trigger is pulled. We call them reflexes. Reflexes correspond to the simplest and most primitive organization of the nervous system. They are not mental acts at all and are very imperfectly under the control of the will. On this account they are sometimes very annoying, when one would be perfectly quiet.

Closely connected with the reflexes but vastly more important

¹ Outlines of the Study of Human Action for the Students' Army Training Corps' Section I.

in their influence on life history are the instincts. Fear of terrifying objects, dislike at being held, satisfaction in human company, mating, solicitude of parent for child, are characteristic human instincts. They are inborn tendencies to reaction rather than specific reflexes. Quite independent of reason they furnish a fundamental basis for likes and dislikes. They are the great primitive drives in our lives. While they are capable of being modified by training and experience, they are practically impossible to eradicate. The neural mechanism of instincts resembles that of the reflexes but it is more complex in central organization. Interacting with each other and with experience instinctive reactions are frequently quite unpredictable. But no human action is free from instinctive bias.

Another kind of human act appears mechanical but is really under control of the will. Such for example are walking, eating, writing, going to sleep, and the responses of trained soldiers to familiar commands. We call them habits.

Most of the details of life are taken care of by habits. They save time. There would be very little progress if every repetition of a routine act in dressing, walking, reading, writing, etc., had to be planned as carefully as its first occurrence. It takes all the time we can spare to plan satisfactory responses to new conditions that are constantly arising. Fortunately, habit takes care of the routine. This makes it the most important factor in training. It will be discussed in Section III.

But if a veteran of the Spanish American War tried to use in the present war the habits he formed then he would be useless to himself and everyone else. Changing conditions in war, in business, in education, in all phases of life demand new plans. Old habits will not always work. When a man cannot adopt new methods to meet new situations, he is "in a rut," "an old fogie," etc.

Actions that are adapted to the circumstances, planned and guided according to the ends one wishes to accomplish, we call voluntary. The capacity to act in this way we call will.

Planning is peculiarly a human process and the condition of all human achievement.

The building of a bridge to carry a specific weight, the organization of a business enterprise, the mobilization of a nation's resources to meet a national crisis are examples.

III. *The Characteristic of Effective Action.*—The reflex sneeze or cough that relieves the mucous tickle is effective if that is all that the situation demands; but it would be a disastrous reaction

if the occasion demanded absolute quiet. Planned or voluntary action like a military operation is effective when it produces the results for which it was planned. If it fails in that no matter how brilliant or pleasing it may be it is futile. The past of most of us has many examples of effective as well as of futile and even disastrous action. Sometimes we planned well. Sometimes the difficulties were too great for our capacities. Sometimes we did not care until too late. We often made mistakes.

IV. *Reaction Time*.—In every group of raw recruits there are some whose reactions are noticeably slower than the rest. They lag behind. Some on the other hand tend to get ahead of the rest. The time it takes a person to start doing what he is told to do we call his reaction time or his latent time. It is one of the functions of military training to weld individuals and groups of men into units that act together. Perfect drill is not the useless military ornament that it often seems to the civilian. It is a sign that the body of men has become unified, trained to dependable military reactions as a body, under the controlling mind of its commander. The reaction time must be equalized and reduced to a minimum. It cannot be eliminated. No response to command can be instantaneous.

The cause of this reaction time is found in the structure of the nervous system. A command must be loud enough so that the sound waves in the air set up sound waves in the bones of the middle ear, and through them in the fluids of the inner ear. There they must excite the sensitive nerve endings that are tuned to that particular sound. Each nerve end reacts according to its own nature and passes its excitement along to other parts of the nervous system, until it finally reaches the muscles and excites them to contraction.

All these processes take more or less time. In the reflexes the number of successive processes is small, the organization is simple, and the latent time may be less than a twentieth of a second. The thing is done before we have time to think.

In habitual reactions, the nerve paths are longer. The number of successive processes is greater and the latent time cannot be reduced under one tenth of a second. This seems short enough but it becomes quite important in fencing, boxing, aiming at a rapidly moving target, etc. The latent time of planned action is always much longer. From the time a question is asked until a student thinks of the answer may range from a few seconds to infinity.

V. *The Personal Equation.*—Sometimes nerve excitement spreads out over the entire body as in trembling. Sometimes it concentrates on a single group of muscles as in moving the eyes to look at an interesting object. Sometimes it produces all the force we are capable of. Sometimes it changes the position of a limb by a hair as in the aim of a sharpshooter. The nice coördination and mutual adjustment of the different muscles of the body for each task that must be performed is the product of training. Muscle groups must be trained to coördinated action just like groups of men. The commander of the body is the brain.

When a spoken command finally reaches the brain through the nerves, it first arouses enough memory of the past to be understood. We must know what the order means. Then the organization of the response begins. How effective the response will be depends on the previous training of the brain that is in command. The raw recruit is utterly useless in battle. The better his training, the wider his practical experience becomes, the more perfectly will the muscles of his body be combined by the brain into smoothly working mutually coördinated responses. It takes months of training to make a first class soldier.

If we knew all the various factors that determine a man's reactions, his understanding, his experiences, and his capacity to coördinate his powers to the accomplishment of the task in hand, together with the rapidity of the whole reaction, we would have a kind of formula which we might call his personal equation. A rough approximation of such a personal equation is present wherever we make an estimate of a person's ability to perform a given task or to fill a position of responsibility.

Knowledge of men means that one's estimate of the personal equation of those with whom he has to do is sufficient for the purposes at hand. Efficient leadership is impossible if gross mistakes are made. It is the aims of Section II to give some practical ways of learning those factors of the personal equation that are essential to military success. Every man's personal equation must be carefully studied to place him where he can do his best for the service.

VI. *Personal Initiative.*—Military organization demands that men act together coördinately, like the muscles of the body, under the orders of the supreme command. Just as too much individual initiative in any one finger would be disastrous to good writing, or too much initiative in one eye would spoil good vision, so too much individual initiative in the men of an army would be disas-

trous. An example of this is seen in the results of the principle of 'self-determination' as practiced by the Russian armies after the Revolution.

As a rule young Americans are strong in initiative. They seem to have a natural inclination for the principle of self-determination, and a natural aversion to discipline. This makes drill all the more important in army training. But while too much initiative is a source of danger to an army when it prevents perfectly coördinated action of privates, in positions of command it becomes of the utmost importance. It is absolutely essential to a leader.

The tendency of the American private to act for and plan for himself is not always disadvantageous. It becomes a military asset when he must act alone or in small detached groups. Americans separated from their unit commands find it particularly easy to recombine. Sometimes a private with initiative will unite a group of others and render important service under circumstances where German troops because of their dependence on the commands of their regular officers would be helpless.

Initiative is absolutely essential in scouting, reconnaissance, and all intelligence service as well as in planning by officers. But not all initiative is adequate. It may miss the object as badly as old habits. To rise to the occasion when a man suddenly faces a new and difficult situation requires more than just doing something quickly. Effective voluntary action means doing just the right thing.

VII. *Practical Intelligence*.—When a mechanic can find the trouble in a stalled automobile and make it go as it should, it is proof of his practical intelligence concerning automobiles. He wouldn't need to know very much about one to wreck it. The ability to plan one's acts to meet new situations successfully is the practical value of mind, the main cause of its evolution. In the competition of practical life with its constantly changing combinations of circumstances, a person cannot win unless he is able to meet new situations as they arise promptly and effectively. This is none the less obvious in business than in war.

It is then of importance for one to study the conditions of effective will if he would make a success of any task he undertakes.

VIII. *Estimating the Situation*.—A good mechanic's first step in repairing an automobile is to locate the trouble. In every event of life from answering a question in an examination to making choice of a profession; from handling a refractory recruit to planning

a military campaign, the first condition of meeting a new situation effectively is to understand it.

The need for complete information in order to plan successful action is the reason for various important parts of the military organization. A commander must have the completest possible knowledge of the strength of the enemy, the kind and disposition of his troops, the nature of his defences, his morale, his intentions, as well as the character of the surrounding and intervening terrain. He must also know every detail of the condition of his command.

Spies, reconnaissance, observation and intelligence service are the commander's eyes and ears. No modern campaign is possible without perfect topographical maps. No detail that can hinder or help any enterprise is too insignificant. Adequate diagnosis is always the first step in treatment.

The converse of the rule also holds true. When the Germans started the war for the domination of the world they took the greatest pains to hide their motives, so that the rest of the world would fail to understand the situation that faced them. They use peace propaganda in the same way. This is the principle of camouflage; it is of fundamental importance in strategy. It is the reason why orders are kept secret, why true Americans are under sacred obligations to maintain absolute silence with respect to every scrap of military information that they are obliged to know.

IX. *Difficulties in Estimating a Situation.*—The difficulties in finding the trouble in an automobile are apparent enough to the inexperienced. They would be increased enormously if the automobile had personal initiative and could plan to deceive us.

We can specify certain typical difficulties in estimating the trouble with an automobile. (1) The absence of gasoline or some other essential factor might be overlooked. (2) A short circuit might be hard to locate even if we knew it existed. (3) We might misinterpret the facts and blame the car when it was our fault after all. (4) Somebody might have planned to deceive us.

Similar difficulties are found in estimating a military situation. The intelligence service must be so organized that no essential fact is overlooked. That is why Germany filled America and the neutral countries with spies and secret agents. When darkness or smoke clouds or natural barriers hide the movements of troops, means must be found for discovering them by search lights, sound detectors and aeroplanes. When the enemy tries to mislead us as to his intentions we must learn to check up different sources of information.

Reasoning from the available reports to the intentions of the enemy is the most difficult process of all.

But all these difficulties can be overcome more or less by training the eyes, ears and minds of responsible persons. That is one of the great tasks of military education. The principles that underly it will be studied in the last section of this course.

X. Clear Intentions.—After the auto mechanic locates the trouble, he must form a clear idea of what he wants to do. This is the second great condition of successfully meeting a situation. Our mechanic might conceivably have any one of several aims. Instead of trying to serve this customer quickly and conscientiously, he might wish to make a big job out of a trivial one, or he might want to delay the car for police inspection, or he might be in a hurry to get to a more profitable piece of work. His main aim will determine his plan of action.

Similarly a case of insubordination must be handled quite differently when it is necessary to make an example than it would be if the aim were to reform the culprit. An attack for the sake of feeling out the enemy will be different from a blow to annihilate part of his line. In all cases after we know the situation we must have a clear idea of what we wish to accomplish before we make our plans. This idea is technically called the "mission." Of course, it is the business of the commander to determine the mission of an attack. But every subordinate must know just what his part of the mission is. This is the reason why orders must be sufficiently unambiguous, and definite so that the mission is fully understood.

Once determined, the mission must dominate the action, and be kept clearly in mind at every stage. While being executed, orders demand the undivided attention of the person to whom they are issued. Only when they are followed absolutely can a commander know what to depend on. For a charge to overrun its planned objectives may demoralize the whole plan of attack. It is the part of a good soldier to stop where he is told to stop as well as to go where he is told to go. But a mechanic cannot do every part of the job at once. In order to reach the trouble he may have to make a new tool, take down the engine, etc. But if he is a good mechanic, he would not take down the engine unless it was essential to his main aim in the job. Inclusive aims we call dominant. The lesser aims that are necessary to accomplish the dominant aim we call immediate or subordinate.

The more inclusive aims in men's lives we call ideals. They determine the person's conduct in endless ramifications and are most important factors in the personal equation. Dominant aims like patriotism, hope of promotion, success, family honor, the good opinion of friends, fear of ridicule, etc., may coöperate or antagonize each other. Obviously, it is much more important and economical to develop the dominant ideas of a group of men than it is to try to control every individual act by itself. The spirit of a company, a school, the morale of a community, an army or a nation is of the greatest consequence to those in positions of responsibility. To build up a fine morale in his command is one of the great tasks of an officer. To indoctrinate his subordinates with his main principles of action is one of the tasks of a great leader. It is the business of propaganda of all sorts to educate or emphasize those dominant ideas that are essential to the success of a task. Offensive propaganda aims to break down the morale of the enemy by encouraging them to believe they are bound to be beaten, that their officers betray them or other ideas that are antagonistic to successful warfare. Defensive propaganda on the contrary aims to develop dominant ideas of responsibility, patriotism, loyalty and the like that tend to successful warfare. Propaganda may be direct or indirect. The direct kind is often the less effective; one sees through it and resists it.

The Germans have studied this matter for years and are past masters not only in direct but in indirect propaganda of the most insidious kind. Every act that tends to break down the morale of our civil population or our soldiers is essentially an act of treason. It may be reasonably suspected of originating with the enemy. The principles that underly morale will be studied in section IV.

XI. *Effect of Dominant Aims on Subordinate Ones.*—If it becomes necessary to take down the engine to repair it, the act of taking it apart is not vandalism. It becomes just as much worth while as the main aim that it subserves. If retreat is the best way to conserve resources for final victory, then a good retreat becomes the immediate goal of action. In view of the idea of future victory, retreat is not disgraceful but glorified. In this way many things that are undesirable in themselves become of real value in the light of the ends they serve. The supreme case of this sort is the sacrifice of life itself for a great cause. But every act in life gets its value as good or bad largely from its relation to some comprehensive plan of life. In the case of an individual, an innocent bit of fun may be

treason if it incapacitates him for his duty. On the other hand, an utterly trivial thing may be invaluable if it takes its place as a necessary condition of some important move. So a wretched night in the trenches may be one of the absolutely essential factors in the plans for victory. Viewed abstractly, war is a dreadful thing and peace highly desirable. If waged for gross material gains or at the demand of junker barons war is utterly inexcusable; but when waged to prevent the enslavement of those we hold dear so that we may hand down our heritage of freedom to our children, it becomes a most sacred duty. Peace under such circumstances would be treason to ourselves and our posterity.

XII. *Mobilization of Resources.*—The third step in successful action is the mobilization of available resources. Just as a country in time of war must know exactly what it can count on in materials, machinery and personnel, just as a commander under attack must know the forces that are available to meet it, so an individual must mobilize all his skill and experience that may have bearing on any important situation that he has to face. What are a man's resources? Some of them are physical and material like health, endurance, money; some are mental like experience, knowledge and skill. Some are social like friends and followers. It is the business of every man as well as every nation to increase his resources to the utmost and to know approximately what they amount to and where they need development. To think he is wiser, or better, or stronger, or more popular than he really is we call conceit. When a conceited man overrates his own strength, he really underestimates the relative strength of the resources of his rival. That leads to foolhardy action and invites disaster.

But timidity is as disastrous as conceit. If one needs more strength and it is essential to one's life work, then he should go to the gymnasium. If it is knowledge he needs or more skill in using his mind or his hands, then he should apply himself to learning. That is what schools are for. It is the business of one who would be an officer to develop those personal resources that are essential to an officer's duties. All resources that are essential to one's life work should be cultivated.

XIII. *Selection of Appropriate Resources.*—Not every thing that the mechanic can bring to bear in taking down an engine is expedient. He must be careful not to damage the parts he removes.

Not all our personal resources are equally valuable for every situation. Physical strength and money are invaluable in their

place, but they lead to disaster if used on an officer of the law. Rhetoric is all right in its place, but if used on most Americans it will only lead to derision. The nice selection of just the right thing to do and say is called tact in social life, but the same sense of fitness and propriety, of justice and truth is important in writing dispatches or in making speeches, in business enterprises or in dealing with one's sub-ordinates, in the classroom, in planning a great military offensive, in short in every voluntary act of practical life.

XIV. *Energetic Action.*—The final step in effective action is to carry out the selected plan with promptness, energy and persistence. Without this final step, no matter how large one's resources or how excellent one's plans, he remains a futile visionary. Without adequate resources an individual or a nation is helpless,—the prey of every designer, the sport of chance. Without tact, the individual is a blunderer, "a bull in a china-shop"; his acts only "gum up the machinery." Without knowledge of the situation a man acts like a fool.

There are five main steps in effectively meeting each new situation. If one has time and the occasion is important each step should be separate and complete. Especially in training oneself to meet new situations there should be no shortcuts. The student will do well to specifically ask himself; Have I correctly estimated this situation? What is my mission? What are my resources? What is the best thing to do in the circumstances? Am I putting my best energy into the task? Later on when training is completed each step will come naturally. Sometimes the whole process will be almost instantaneous. But the lightning-like reactions of a trained mind are not careless or superficial. They are quick because training eliminates waste motions. To be effective no one of the five main steps may be neglected.

XV. *Application.*—The principles of effective action that we have been considering apply to many more cases than we have enumerated in illustration. If you are studying this course to get the most you can out of it then don't merely learn them but practice them.

Take the case of the German spy system and analyze it; understand its significance, how far it was successful, how it failed. Analyze the task of a life insurance salesman step by step and see what the principles you have studied lead him to do. Consider several concrete military facts like inspection, the S.A.T.C., the

anti-submarine warfare and study the application of each of the principles you have learned. Then recall in detail situations to which you have failed to rise, and analyze out the reasons.

Answer the following questions in terms of the principles.

Why is a paralyzed man clumsy?

Why is Holland neutral?

What is the use of a college education for officers?

What is the purpose of the military salute?

Finally apply the principles to the job you are now doing. Get the habit. You will suddenly find yourself rising to occasions that yesterday seemed far beyond you.

INDIVIDUAL DIFFERENCES¹

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If we could adequately describe each of a million human beings,—if, for each one, we could prophesy just what his response would be to every possible situation of life,—the million men would be found to differ widely. Probably no two out of the million would be so alike in mental nature as to be indistinguishable by one who knew their entire natures. Each has an individuality which marks him off from other men. Each has not only a mind, the mind of the human species, but also his own, specialized, particular, readily distinguishable mind. Even in bodily nature, indeed, men differ so much that it would be hard to find, amongst a million, two whose features are just alike, who are equally susceptible to every disease, who have identical bodily habits. The differences in intellect and character are far greater.

We may study a human being in respect to his common humanity, or in respect to his individuality. In other words, we may study the features of intellect and character which are common to all men, or we may study the differences in intellect and character which distinguish individual men.

The study of the facts and laws applicable to all men by virtue of their common humanity gives us fundamental rules for the control of changes in intellect and character. The study of the facts and laws of individual differences enables us to apply these principles economically in the case of each individual whom we seek to influence.

In studying individual differences, it is customary to reduce the infinitude of tendencies to think and feel and act in certain ways in response to the varied situations which life offers, to the more general, and so fewer, tendencies which the psychologist calls abilities, interests, habits, qualities of mind, or mental traits.

¹ Outlines of the Study of Human Action for the Students' Army Training Corps, Section 2.

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Thus the hundreds of connections between the situations represented by all the possible problems in addition and the responses represented by all their solutions, are reduced to the one trait, "ability to add." Thus the many inborn connections between, on the one hand, seeing and touching blocks, sand, strings, wire, stones, water and other material objects, and on the other hand examining, poking, pulling, putting together, taking apart, forming and reforming those objects, are comprised in the one trait, "the instinct of constructiveness" or "the interest in manipulation."

Individual Differences in Single Traits.—It is useless to recount the traits in which men have been found to differ. For there is no trait in which they do not differ. Of course if the scale by which individuals are measured is very coarsely divided, their differences may be hidden. If, for example, ability to learn is measured on a scale with only two divisions, (1) "ability to learn less than the average kitten can" and (2) "ability to learn more than the average kitten can," all men may be put in class two, just as if their heights were measured on a scale of one yard, two yards, or three yards, nearly all men would alike be called two yards high. But whenever the scale of measurement is made fine enough, differences at once appear.

The differences exist at birth and commonly increase with progress toward maturity. Individuality is already clearly manifest in children of school age. The same situation evokes widely differing responses; the same task is done at differing speeds and with different degrees of success; the same treatment produces differing results.

There can be little doubt that of a thousand ten-year-olds taken at random, some will be four times as energetic, industrious, quick, courageous, or honest as others, or will possess four times as much refinement, knowledge of arithmetic, power of self-control, sympathy, or the like. It has been found that amongst children of the same age and, in essential respects, of the same home training and school advantages, some do in the same time six times as much, or do the same amount with only one tenth as many errors.

The ways in which and to the extent to which individuals differ in mental traits can be best understood by considering the *Distribution* of the trait, that is, the number of individuals possessing each degree of it. For example, the distribution of stature in American boys ten and a half years old is roughly as follows:

Out of 1,000 boys, there are:

Between 109 and 113 centimeters tall,				2 boys,	
"	113	"	117	"	5
"	117	"	121	"	25
"	121	"	125	"	97
"	125	"	129	"	199
"	129	"	133	"	255
"	133	"	137	"	228
"	137	"	141	"	126
"	141	"	145	"	49
"	145	"	149	"	11
"	149	"	153	"	4

The facts of this table become clearer to the eye if, instead of the numbers 2, 5, 25, 97, etc., we draw 1000 little lines as in Figure 1, letting each line stand for one boy.

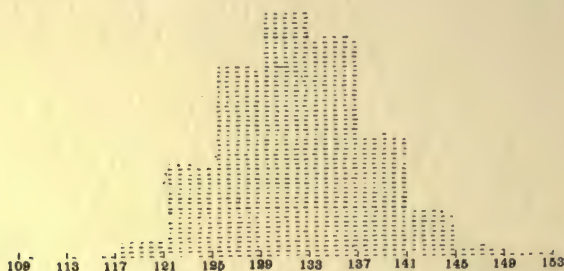


FIG. 1. Showing the distribution of stature in 1,000 American boys. Each individual represented by a line.

It is customary to represent the amounts of the trait not by a verbal statement like "from 109 cm. to 113 cm.," but by a distance along a scale from the point on the scale marked 109 cm. to the point marked 113 cm.; and to represent the number of individuals who possess that degree of the trait not by the number of lines, but by the size of an area. The previous table then becomes Fig. 2.

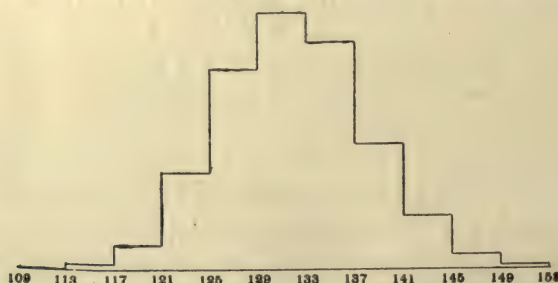


FIG. 2. Showing the distribution of stature in 1,000 American boys. The areas represent the number of each height.

Such a figure is called the *Surface of Distribution* of the trait. Such distribution tables or surfaces are, so to speak, the language of individual psychology. They tell us what the "type" or "norm" or common tendency is, how and how far individuals vary from the type, whether there are secondary or sub-types, how "abnormal" any given degree of the trait is, and the like. For instance, in the case of our illustration, it is clear that there is one central tendency, the typical height for a boy of this age being about 133 cm.; that slight individual variations from the type are very numerous, but that large variations from it are very rare; that the variations are continuous, individuals being found of every height from 110 cm. to over 150 cm.; that a boy over 149 cm. tall at the age of ten and a half would be abnormal in the sense that he would occur only once in two hundred and fifty times, but would not be abnormal in the sense of being removed from ordinary children by a distinct gap.

All thought about individual differences in single traits should be carried on in terms of such distribution tables or surfaces, each derived from the actual measurement of a large representative group of individuals. It is misleading to form opinions from casual observations of human nature without accurate measurements. For casual observation is struck by extreme, odd, exciting, and desired facts. It notes, for example, that two railroad wrecks occurred at the same day and hour, that it has not rained for two months, that Walter Scott was thought dull as a boy, that the rule of the Republican party has greatly increased (or decreased) prosperity. It is misleading to judge from measurements of a few individuals. For their meaning can be rightly seen only by comparison with the total distribution in respect to the trait in question. In theory and in practice, we must think of an individual in any one trait not only as he is in and of himself, but as he is in relation to all men,—as one variation amongst others in the total distribution in respect to that trait. There is indeed no one habit of thought about human nature more important for the understanding of individuality than the habit of thinking of the different amounts or degrees of each single quality or trait as distances along a scale, and of men and women as distributed along that scale each at his proper point.

The study of such distributions in the case of qualities of intellect and character, has brought to light two facts, both at variance with common opinion and both of importance for the practical treatment of individuals. First, *the variations in any single trait are usually*

continuous. Second, the variations usually cluster around one and only one type.

The continuity of variations appears in every trait that has so far been measured. Men rarely or never fall into distinct classes with gaps between,—bright, average, and dull, sane and insane, visualizers and non-visualizers, courageous and cowardly, and the like. On the contrary, between the least and the greatest, the best and the worst, every degree is represented.

The clustering around one type, though not perhaps as universal as the continuity of variations, is also to be expected, save under certain conditions in the causes that produce the trait. The true state of affairs is that shown by such distributions as those of Fig. 3,

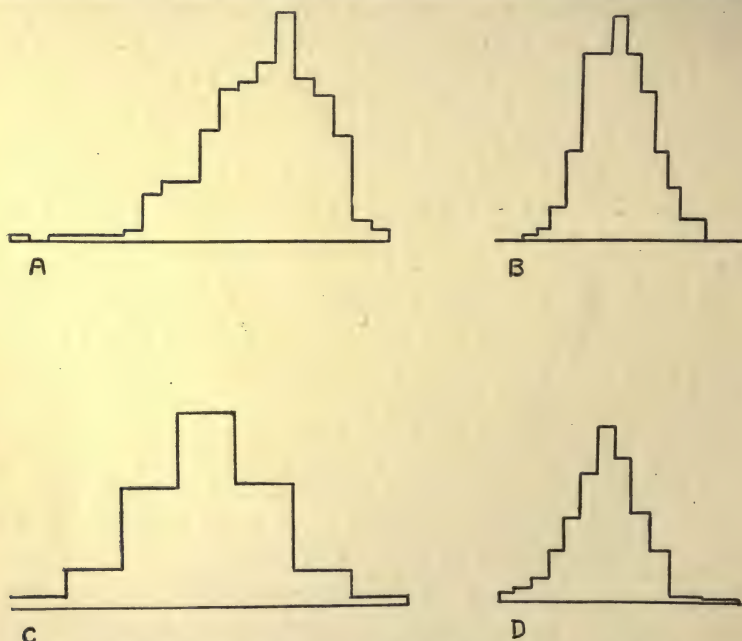


FIG. 3. Showing the distribution with the clustering around the type.

not by such as those of Fig. 4. We must not be misled, by the habit of thinking in words, into the false belief that individualities are grouped into classes to fit those words. The usages of language are rarely competent to express the real fact of variations clustering around one type or mode and, as the variation increases, occurring in ever-diminishing frequency. That we call people good or bad does not mean that there are two types or modes of character. That

the words "deficient," "normal," and "superior" are used of any trait is no proof that individuals in that trait show a separation into three groups, all in one group being much like one another and little like any of those in the other groups.

We must learn to think of the degree or amount of any quality

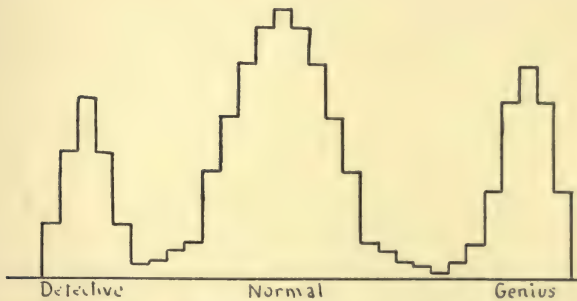
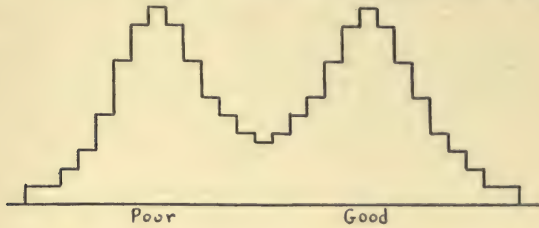


FIG. 4. Showing an anomalous distribution.

in an individual not by an adjective, but by a numerical amount. In the great majority of single traits, there is only one type or mode, so that any division into distinct classes according to the amount of the trait is arbitrary. The distribution being as in Fig. 5, it is equally possible to divide individuals into two, three, four, five,



FIG. 5. Showing a normal distribution with possibility of making smaller groups.

six, seven, eight, or eight hundred classes; and for any given number of classes one may put the dividing lines in one place as well as another. Consequently classifications of individuals with respect to the amount of any single trait are almost always useless if not misleading. The story is to be told, not by a series of names, but by a surface of distribution erected on a numerical scale.

Turning again to Fig. 3, one notes that all the distributions there shown have, as a common feature, the great frequency of mediocrity and the rareness of both specially low and specially high degrees of a trait. Approximately this is the rule for the original individualities of mankind. Approximately this remains the rule for many traits throughout the course of life and its training. In many traits a very small difference in ability or attitude near the middle point of the scale includes a great many individuals. This fact explains much in human behavior. For instance, social and political movements are often instigated by individuals who are at the extremes of the scale with respect to some doctrine. But the deciding votes are almost always cast by individuals who have no very pronounced inclination in either direction. The attractiveness of some hero, the suggestive power of some battle-cry, an affront to the sense of fair play, a year of hard times, a moderate expenditure of money, even the mere desire for novelty, may turn the balance, because only a slight addition to the attractiveness of one proposal is needed to move a great number of those near the point of neutrality. To overturn a large majority requires only a small change in opinion. A slight improvement in teaching may make a misunderstood point clear to a large percentage of the class.

The facts that have been stated concerning the distribution of single traits prove that any method of managing men which is the best possible for those of one degree of a trait cannot be the best possible for all individuals. Nor will two or three varieties of treatment suffice to influence all in the best way. Variations in human nature are wide and continuous, so that theoretically treatment also must vary much and continuously.

Individual Differences in Combinations of Traits.—The variety of human nature possible when one man is compared with others in respect to all possible traits is practically infinite. Even if man's nature included only five traits, *a*, *b*, *c*, *d*, and *e*, and even if each of these existed in only five degrees, 1, 2, 3, 4, and 5, there could be over three thousand (3,125, to be exact) varieties of men. With hundreds of traits, each represented in hundreds of degrees, the

varieties possible are practically infinite. All the principles involved can, however, be understood in a simplified case such as that of the five traits, each appearing in five degrees. In the simple case any one individual would be represented by an equation such as:

$$\text{W. Roberts} = 2a + 2b + 5c + 3d + 3e,$$

$$\text{John Smith} = 1a + 4b + 2c + 5d + 1e,$$

$$\text{H. Thomas} = 4a + 1b + 1c + 2d + 3e,$$

or, more clearly, by a series of points on the five scales for the five traits as in Fig. 6.

Over three thousand varieties are possible, but they need not

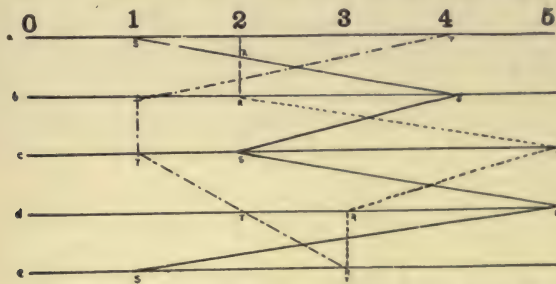


FIG. 6. The combinations of traits of three individuals.

all occur. For example, suppose that the amount of trait *a* that an individual possessed was so related with the amounts of *b*, *c*, *d*, and *e* that he possessed, that if he had *2a* he would have also *2b*, *2c*, *2d*, and *2e*, while if he had *4a* he must have *4b*, *4c*, *4d*, and *4e*, and similarly for *1a*, *3a*, and *5a*. Then the only varieties of individuals that could exist would be:

$$\text{Some who were } 1a + 1b + 1c + 1d + 1e,$$

$$\text{" " " } 2a + 2b + 2c + 2d + 2e,$$

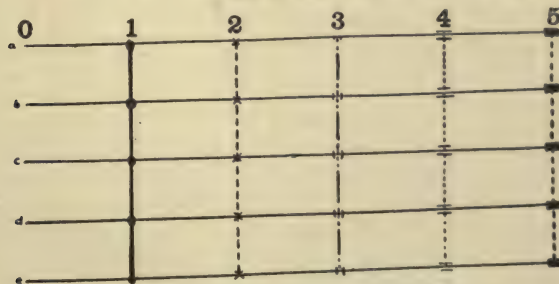


FIG. 7. Five possible types of individuals.

and so on, five varieties in all, shown in Fig. 7. Or suppose that an individual having 5*a* could never have less than 3 of *b*, *c*, *d*, and *e*. Then such individualities as—

$$5a + 2b + 4c + 3d + 5e,$$

$$5a + 5b + 1c + 4d + 3e,$$

and the like could not exist. The kind of varieties that can exist will then express the relations, or, as they are commonly called, the *correlations*, between the amounts of the five traits, that is, the extent to which the amount of one trait possessed by an individual is bound up with the amount which he possesses of some other trait. This is as true for five hundred traits as for five, and for an infinite number of degrees of each as for five degrees. *What kind of individuals there will be, and what proportion there will be of each kind, is a result of the distribution of individuals in single traits and of the correlations of the traits.* To this fact we shall soon need to return.

Confronted by the infinite variety of total human natures, thinkers have hoped to find certain types—the genius, the insane, the criminal, the defective, the artist, the man of affairs, and the like,—such that all, or at least many, individuals would belong under one or another of these types. A type represents some particular combination of amounts of the list of human traits. For example, suppose the list of traits to be *a*, *b*, *c*, *d*, and *e*, and the degrees of each to range from 0 to 10. The combinations

$$(I) \quad 2a + 5b + 5c + 8d + 10e,$$

$$(II) \quad 10a + 2b + 2c + 1d + 0e,$$

$$\text{and (III) } 4a + 4b + 4c + 6d + 5e,$$

would be possible types. They are represented graphically in Figure 8.

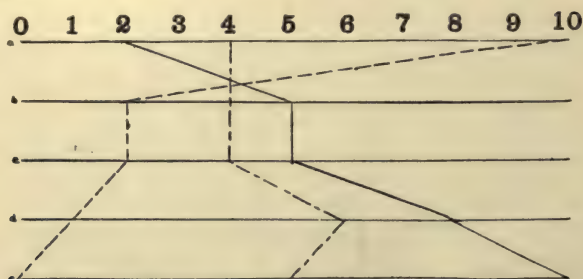


FIG. 8. Three types of individuals.

Now such individuals as:

- (1) $1a + 4b + 5c + 9d + 9e$,
 or (2) $3a + 4b + 5c + 8d + 10e$,
 or (3) $2a + 5b + 6c + 8d + 10e$,

obviously vary little from Type I, but much from Type II or Type III.

Such individuals as:

- (4) $10a + 1b + 2c + 0d + 2e$,
 (5) $9a + 2b + 2c + 2d + 1e$,

vary little from Type II, but much from Type I or III. Consider similarly such individuals as:

- (6) $4a + 5b + 4c + 6d + 3e$,
 (7) $2a + 4b + 4c + 5d + 4e$,

These facts are easily seen in Figure 9, which represents Types I, II, and III and individuals I to 7.

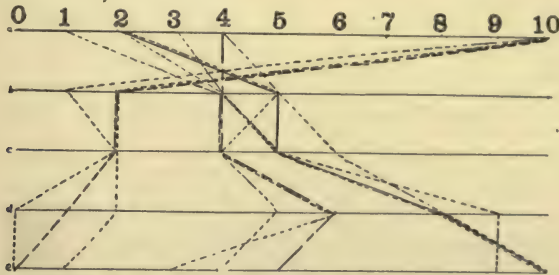


FIG. 9. Representing seven individuals of types I, II, and III.

The customary view has been that "types" or particular combinations of amounts of human traits, could be found so that any individual would be much like some type and much less like any of the others. But no one has succeeded in finding such types, and the more clearly the supposed types are defined, the surer it becomes that intermediate conditions, equally like several of the types, exist in great numbers. Either new types have to be added until there are so many that one may as well let each individual be his own type; or the number of individuals not falling readily under any type is so large that the attempt to classify men by them hinders

rather than helps thought and practical control. Only very rarely can anything approaching at all closely to an accurate and adequate account of a man's individuality be given by the statement that he is of this or that "type."

In fact, there is much reason to believe that human individualities do not represent ten or a hundred or a thousand types, but either *one single type* or *as many types as there are individuals*, according to whether the thinker wishes to emphasize the common humanity around which they vary or the exact nature of their variations from it. By this view the effort to assign individuals to a number of classes, as we assign animals to the classes "mammals," "reptiles," "amphibians," "fishes," etc., is doomed to failure or incompetence. The first duty of the thinker is to learn the constitution of the one type, *man*. His second duty is to learn each individual's variation from this common humanity. In theory it means that man is mentally, as much as physically, one species. In practice it means that each individual must be considered by himself.

It certainly is the case that almost all of the detailed classifications of individuals in accord with the multiple-type theory are either useless or misleading. The commonest element in such classifications is the supposed principle of compensation or balance, whereby, for example, a "quick but careless" type is contrasted with "slow but sure" type; or an "easy learning, quickly forgetting" type is contrasted with the slow learner who retains long; or efficiency in thought, efficiency in action, and delicacy in sentiment are supposed to be exclusive, each of the other two. Such types, presupposing relations of compensation between intrinsically desirable traits, are almost certainly illusory.

All trustworthy studies so far made of the relations between the amounts of desirable single traits in the same individual agree in finding direct or "positive" relations between such traits. Having a large measure of one good quality *increases* the probability that one will have more than the average of any other good quality. He who can learn better than the average through the eyes, tends to learn better than the average through the ears also; he who can attend to one thing better than all other men, will be able to attend to many things at once or in rapid succession better than most of them. Artistic ability, as in music, painting, or literary creation, goes *with* scientific ability and matter-of-fact wisdom. The best abstract thinker will be above the average in concrete thought also.

The rapid workers are the most accurate. Intellectual ability and moral worth hang together.

The correlations are, of course, not perfect. A large degree of superiority in one desirable trait may involve only a slight superiority in many others. And since the relations vary enormously amongst individuals, a person highly gifted in one respect will often, though not usually, be very inferior in others.

TESTS OF GENERAL INTELLIGENCE

BY L. M. TERMAN

Stanford University

The preceding study of individual differences has shown us how enormously men differ in mental ability, and how important these differences are in determining one's fitness for a given kind of work. Now the work to be done in the army ranges in intellectual difficulty from that which can be done by any who is able to use a pick and shovel to that which demands the highest type of insight and resourcefulness. If the army is to be efficient it is evident that the work which requires most brains must be given to men with brains. We can easily imagine what would become of an army if all the men in it who were fit to command were set to digging the trenches, and if those fit only to dig trenches were made its officers. Plainly if the army machine is to work smoothly and efficiently it is as important to fit the job to the man as to fit the ammunition to the gun.

Of a million drafted men sent to receiving stations, several thousand will have to be rejected for mental deficiency, several thousand will be mentally unable to learn the drill but will be able to do useful labor in service battalions, several thousand will be needed for officers, and the remainder will have to be trained for various tasks of intermediate difficulty. How shall we go about it to place each man as nearly as possible at his proper level, that is to say, at the place where he can render his maximum contribution to the service? By some method or other the intelligence of every soldier will have to be estimated or judged. How shall it be done?

The Method of Trying Out.—One method would be to try out each soldier in tasks of various degrees of difficulty. The method is fairly sure. It could probably be depended upon to give us an efficient army within a few years.

So with the method of natural sifting. If the war should last long enough the best men would pretty certainly in time demonstrate their ability and rise to positions of responsibility, while those of poorest mentality would gravitate to the humbler tasks. But the gravitational method of sifting meets many resistances, and like the method of trying out, is necessarily very slow.

Pseudo-scientific Methods of Rating Mentality.—A century ago a French physiologist, by the name of Gall, founded what he thought was a new science, which was named phrenology. According to phrenology, definite and constant relations were believed to exist between certain mental traits and the contour of the head. It was believed, for example, that one's endowment in such traits as intelligence, combativeness, sympathy, tenderness, honesty, religious fervor, and courage, could be judged by the prominence of various parts of the skull.

It is unnecessary to question the sincerity of Gall and his over-enthusiastic followers. They were probably not guilty of conscious deception, but merely blinded by an attractive theory. At any rate, the "science" of phrenology has been hopelessly exploded. It has been well demonstrated:

- I. That traits like those mentioned above do not have separate and well defined seats in the brain, and
2. That skull contour is not a reliable index of the brain development beneath.

In the underworld of pseudo-science, however, phrenology and kindred fakes still survive. Hundreds of men and women still earn their living by "feeling bumps on the head," reading character from the lines of the hand, etc., But modern warfare has no time for pseudo-science. A general would no more think of selecting his officers by phrenological methods than of substituting incantations for gun powder.

The Method of Off-hand Judgment.—But if in the rating of men pseudo-science is misleading, perhaps science is still unnecessary. It may be argued that mental traits can be rated accurately enough for all practical purposes on the basis of ordinary observation of one's behavior, speech, and appearance. We are constantly judging people by this off-hand method, because we are compelled to do so. Consequently we all acquire a certain facility in handling the method. For ordinary purposes it is infinitely better than nothing. A skillful observer can estimate roughly the height of an aëroplane; but if we would know its real height we must use the methods of science and perform a mathematical computation.

The trouble with the observational method is its lack of a universal standard of judgment. One observer may use a high, another a low standard of comparison. A four-story building in the midst of New York's "sky scrapers" looks very low; placed in the midst of a wide expanse of one-story structures it would look

very tall. The captain of a very superior company may rate his least intelligent man as "very dull"; the same man in a very inferior company would likely be rated as "average" or better.

Moreover, we are easily misled by appearances. The writer knows a young man who looks so foolish that he is often mistaken by casual acquaintances for a mental defective. In reality he is one of the half dozen brightest students in a large university. Another man who in reality has the mentality of a ten year old child, is so intelligent looking that he was able to secure employment as a city policeman.

Language is a great deceiver. The fluent talker is likely to be over-rated, the person of stumbling or monosyllabic speech to be underrated. Similar errors are made in judging the intelligence of the sprightly and the stolid, the aggressive and the timid, etc. Our tendency is also to overestimate the intellectual quality of our friends and to underestimate that of persons we do not like.

If the method of off-hand judgment were reliable, different judges would agree in their ratings of the same individual. When the judges disagree it is evident that not all can be correct. When intelligence is rated in this way wide differences of opinion invariably appear. Twenty-five members of a university class who had worked together intimately for a year were asked to rank the individuals of the class from 1 to 25 in order of intelligence. The result was surprising. Almost every member of the class was rated among the brightest by someone, and almost every member of the class among the dumbest by someone. Doubtless the judges were misled by all kinds of irrelevant matters, such as personal appearances, fluency of speech, positiveness of manner, personal likes and dislikes, etc. Think how much error there would be if a company commander were rating the intelligence of 250 men newly assigned to his command.

The method of personal estimate is much better than the method of external signs (phrenology), but to be reliable it must be supplemented by a method which is *objective*; that is, a method which is not influenced by the personal bias of the judge or by such irrelevant factors as appearance, speech, or bearing of the one to be rated. Such is the method of intelligence tests.

Intelligence Tests a Method of Assaying Mentality.—A man wishes to find out the value of a gold bearing vein of quartz. How shall he set about it? One way would be to uncover all the ore and extract every ounce of gold contained in it. It is hardly necessary

to point out that this would be a slow and risky procedure, one that might easily cost a fortune and bring small returns. But granting that the extent of the quartz vein was known and that the cost of bringing it to the surface could be calculated, would this be sufficient to tell us the value of the mine? The answer is obvious; something depends on whether the quartz contains many dollars worth of gold or only a few pennies worth, per ton of ore.

However, the next step is easy. It is only necessary to take a few random samples of the ore to an assayer, who makes a simple test and returns the verdict of so many ounces of gold per ton of rock. The verdict of the assayer may justify the expenditure of a million dollars, or it may tell us the mine is not worth a penny. At any rate the question of value is answered.

Suppose the question before us is not the value of a gold bearing vein of quartz, but the intellectual quality of a human mind. If we are to rate the quality of a man's intelligence will it be necessary to make this intellect perform every act of which it is capable in order that these may be added together for a total intelligence rating? This would be one method of answering the question, but a rather tedious one, considering the innumerable acts which a human mind is able to perform. Perhaps this is not necessary. Conceivably it might be possible to sink shafts, as it were, at certain critical points, and by examining a few samples of the mind's intellectual product to estimate its intrinsic quality by a method analogous to that of the assayer.

Such is the method employed in all systems of testing intelligence. The mind is given a number of "stunts" to perform, each of which requires the exercise of intelligence. By the quality of these the quality of the entire mind is judged. The tests tell us whether the mind in question is one of rich content and rare intellectual power, or whether it is mediocre or perhaps even defective.

Collecting Samples for Assaying.—In ascertaining the value of the gold deposit would it be safe to take all the assayer's samples from a single part of the quartz vein? Common sense would of course suggest the precaution of taking samples from many places and of estimating the gold content in terms of average richness. Similarly in testing intelligence the subject is not asked to perform one intellectual "stunt," but many. He may be given tests of memory, of language comprehension, of vocabulary, of orientation in time and space, of ability to follow directions, of knowledge about familiar things, of judgment, of ability to find likeness and differ-

ences between common objects, of arithmetical reasoning, of resourcefulness and ingenuity in practical situations, of ability to detect the nonsense in absurd statements, of speed and richness of mental associations, of power to combine related ideas into a logical whole, of ability to generalize from particulars, etc. The average of a large number of performances thus gives a kind of composite picture of the subject's *general intelligence*.

Intelligence Scales.—Such a system of tests, chosen for variety and for reliability, is known as an “intelligence scale.” Many intelligence scales have been devised. The first was that of the French psychologist, Binet, who was aided in his work by the French physician, Simon. As left by its authors the Binet-Simon scale included fifty-four tests, ranging from tests so easy that they can be answered by a majority of three-year-old children to tests so difficult that they tax the intelligence of an average adult.

The Binet-Simon scale has since been extended to include ninety tests and to sample a greater variety of mental functions. Once a feasible method of mental measurement was demonstrated, it was easy enough to construct other intelligence scales. Now we have many, including three which were devised specially for use in the army. Gradually the method was applied to other kinds of mental probing, so that now tests are available for various mental processes other than the intellectual.

The essential principle of all intelligence scales is the same. Always it is the method of the assayer. Typical samples of intellectual activity are collected and then subjected to analysis.

Use of Standards in the Rating of Samples.—Supposing our intelligence scale has given us sample intellectual products, how are these samples assayed; that is, interpreted? What does it signify, for example, whether a subject being tested can think of a hundred words or only forty words in three minutes? Whether he puts together the parts of a form board in thirty seconds or two minutes? Whether a series of seven digits or only a series of three can be repeated after a single hearing? Whether there are three, two, one, or no successes in the attempt to draw a diamond shaped figure from copy?

The secret lies in the standardization of the tests. Without standards for comparison the tests mean nothing. Standardization has come to play the same rôle in psychology that it has long played in other lines of applied science. Two pieces of steel may look very much alike, but standardized tests may show that one is capable of

withstanding twice as much strain as the other. Two drops of blood may be indistinguishable in appearance, but a simple physiological test may show that one has been taken from a healthy, well nourished person, the other from a person who is anemic or diseased. There are a few things which appear more alike on casual inspection than the balls of two thumbs; yet one who has been taught the trick can find in a finger print forty or more separate characters, a single one of which will distinguish it from the finger print of any other human being.

So it is with mental tests. The "sample" product secured by an intelligence test acquires real meaning only when it is compared with samples secured from all sorts of individuals, including children of all ages, adults of all degrees of intelligence, feeble-minded, insane, geniuses, etc. Just as a man may be hanged on the evidence of his finger prints, so a man may be discharged from the army for feeble-mindedness on the evidence of a half dozen standardized tests of intelligence. More important still, the tests quickly identify men whose mental superiority fits them for special responsibilities.

Advantages of the Test Method.—Summarizing, the test method has four great advantages:

1. It gives us a universal standard of comparison. The result is absolutely uninfluenced by the general intellectual level of the group with which the subject to be rated happens to be associated. It is like measuring the height of a house instead of estimating it by comparison with the height of surrounding buildings.

2. It multiplies enormously the significance of a mental performance. It does this by making fine distinctions which would be overlooked by the method of off-hand judgment. It is like placing a smeared glass under a microscope and discovering that the smear is a complicated network of organic matter.

3. The test method is objective; that is, free from the influence of personal bias. It gives approximately the same verdict today, next week, or next year. It does not change its opinion. More important still, the verdict will be approximately the same whoever makes the test, whether a relative, a stranger, a friend, or an enemy, provided only the rules of procedure be rigidly followed.

4. The test result is little influenced by the subject's educational advantages. In this it differs greatly from off-hand judgment, which so easily mistakes the results of schooling for real intelligence. The test method probes beneath the veneer of education and gives an index of raw "brain power." For example, a young woman who

had been stolen in early childhood by gypsies and had spent her life with them, was given the Binet-Simon intelligence test. She had never attended school a day in her life and had only learned to read by bribing a little school girl to teach her the alphabet; yet she made a higher score than the average found for two hundred high school pupils who were given the same test.

No wonder mentality tests have acquired such a wide vogue in the ten years since Binet gave to the world the first successful intelligence scale. In that time they have demonstrated their usefulness in the study of the feeble-minded, in the grading of school children, in determining the mental responsibility of offenders, and in the selection of employees. Their largest and most useful applications has been in the mental classification of men in the United States Army.

QUESTIONS AND PROBLEMS

1. Suppose you had to indicate, within a few days, the best and poorest men in a draft quota of 1,000. What methods would you rely upon if mental tests were not available?

2. What factors are likely to weigh too heavily in determining a man's reputation for intelligence?

3. Mention all the things you can think of which cause us to underestimate a person's intelligence. To overestimate it.

4. It has been emphasized in this chapter that different people use different standards in judging the intelligence of a man. Does the standard used by any one person remain constant, or does it vary from time to time?

5. Is the borderline between normal intelligence and feeble-mindedness sharply defined? Look up some of the definitions of feeble-mindedness in current psychological literature and criticize them from the point of view of scientific exactness.

6. Examine the tests in the Binet-Simon Intelligence Scale and try to find the essential differences between tests of this kind and the questions which any person might ask another in order to "size him up." Wherein is the Binet type of question better?

7. Test your vocabulary on the Stanford Vocabulary Test. (Instructor will supply the list of words from the Stanford Binet Record Booklet.)

8. An experiment in the off-hand estimation of intelligence.

Problem: To find how well different persons agree in estimating the intelligence of an individual.

Method: Members of the class rate one another and compare results. The following procedure is recommended:

(a) Let the basis of rating be the numbers from 40 to 1. Let 40 represent the brightest university student you have ever known, 1 the dullest, and 20 the student of average intelligence. The rating 30 would be half way between the average and the brightest, and 10 half way between the average and the dullest.

(b) Each student is given a list containing the names of all the members of the class. He rates the intelligence of *every student whom he knows by sight and whom he has heard talk for a least a few minutes*, indicating his rating by writing a number from 1 to 40 after the name. The list, containing ratings, is then passed in, unsigned, to the instructor (or to a member of the class chosen for the purpose).

(c) The instructor (or specially designated student) tabulates the ratings received by each member of the class and reports the amount of agreement and disagreement, of course omitting names.

Results.—1. Is there anyone in the class who received the same rating from all his judges?

2. What is the average difference in points between a man's highest and lowest rating?

3. Do the judges agree better on some individuals than on others?

4. How reliable is the rating given a man by a single judge?

GENERAL REVIEWS AND SUMMARIES

CUTANEOUS SPACE

BY HAROLD E. BURTT

Harvard University

Brown and Stewart (2) studied the errors of tactual localization of a soldier with cutaneous hypoaesthesia due to a bullet wound in the left parietal lobe. The experiments were made fourteen months after the wound was received. The affected hand was screened from the subject's view and a series of spots on the fingers stimulated by a bristle. The subject indicated on a model the spot where he felt the stimulus. Then certain spots were "trained," *i. e.*, stimulated with the subject aware of which was to be touched or actually watching the process. Trials of the original sort were frequently intermixed. With two of the trained spots there was a marked improvement in accuracy of localization,—62 and 110 per cent.,—while with the other trained spot and the untrained ones the improvement was very slight. Aesthesiometer experiments on the same individual showed a very high threshold on the affected side of the body and when the duality was recognized the points seemed very close together.

Foucault (5) investigated the tactual perception of linear extension on the finger by the application of two aesthesiometer points separated by a distance which gave the impression of a line. The subject reproduced with a pencil and paper the length of the apparent line he had perceived tactually. In some instances the stimulus was moved on the skin during the trial. The error of reproduction was found to decrease with increase of the distance between the two points. Movement made the apparent length of the lines increase. Practice did not, in general, reduce the errors.

Fitt (4) presented with two simultaneous unmoved points distances above the tactual spatial threshold. The constant method was used with a visual distance (between two dots) as normal and a tactual distance as variable. Results were obtained for the fingers, cushion of hand, back of hand, forearm and back of neck. The general law seemed to be that parts of the skin with a small spatial threshold (more mobile parts) overestimated distances, and in passing to regions with higher threshold (less mobile parts) this

overestimation decreased through the zero point to underestimation. It is suggested that originally there was general underestimation but through the course of evolution this tendency decreased much as the tactual threshold itself decreased. Plotting the percentage of over or under estimation (ordinate) against the corresponding space threshold (abscissa) for groups of different ages from six to adult, the curves all sloped downward to the right,—the general law (*supra*),—but the total curves for the youngest and oldest individuals were higher. That is at ages ten to twelve the judgments were all underestimations while at the age extremes there were overestimations for the regions of the skin with small thresholds. This breakdown in the touch sight coördination in childhood, it is suggested, is due to the change from the seeing and handling of infancy to the abstraction of school life, and the subsequent improvement is due to the acceleration of puberty.

Waterman (7) presented circular tactual stimuli (ends of tubes) of various sizes to the palm of the hand and the tip of the tongue. The subject in each case indicated which of a graded series of circles on a card before him was the same size as the circle felt. With the stimuli used, varying in circumference from 1.5 to 6 cm., there was an average underestimation with both hand and tongue. The underestimation with the hand was greater, 27 per cent. as contrasted with 18. The individual variations in the estimation of sizes were greater for the hand than for the tongue. The average deviations for hand and tongue showed no difference.

Burt (3) studied the tactual illusion of movement produced on the forearm by two punctate stimuli in quick succession and a discrete distance apart. A row of brass rods actuated by solenoids gave the stimuli. The time distance and intensity factors were varied and their interrelations necessary to produce the optimal impression of movement determined. It was found that the longer the stimuli were applied the relatively shorter was the optimal interval between their applications; the greater the distance between the stimuli the greater the time interval; the greater the intensity the smaller the interval and the greater the distance the greater the intensity. If the intensity of the second stimulus was greater than that of the first the illusory movement was some times in the reverse direction. These results are similar to those of other studies of the illusion of movement in vision and audition. The existence of the illusion in all three sense departments and of the same relations between the intensity, time and distance variables

in all three cases points to a common explanation which is found in the action theory and the continuity of motor impulses involved in bringing the stimuli into the focus of attention.

In two studies comparing blind and seeing individuals in various respects there are results which bear on the topic under review. Seashore and Ling (6) found no significant difference in the two-point threshold on the forearm and finger between normal and blind children. On the finger, however, the normal group had a greater mean variation. Bond and Dearborn (1) tested boys in an institute for the blind and in a technical school with a complicated form board. The normal boys average nine months older but made three times as many errors and took nearly half again as long. The authors consider that "the higher degree of sensibility to touch and to the feelings of movement and position in the blind is demonstrated" and suggest that it is due to training.

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SPACE ILLUSIONS

BY HARVEY CARR

University of Chicago

Peterson (4) describes two cases of the autokinetic illusion exhibited by a camp fire perceived at night against a distant mountain side. The illusion disappeared when a near object was used as a sight, but it reappeared with usual conditions of observation.

Downey (3) studied the relation of intelligence to the proof read-

er's illusion with 43 students. The group was divided into two sections on the basis of the pooled results from five intelligence tests. This division was said to correlate with class room ability. The two sections were compared as to their ability to note errors in copy. Members of the more intelligent section were the quickest to detect and correct such errors.

Burt's papers (1, 2) concern the illusory perception of motion induced by the successive presentation of two spatially discrete stimuli. In the first auditory stimuli were employed and the illusion was obtained under certain conditions. Individuals differ in their susceptibility. Suggestion is an effective factor. In studying the relation of the duration of the sounds to the length of the intervening period, it was found that an increase in the duration of exposure necessitated a decrease in the interval to secure the maximum of illusory effect. The direction of the illusion may be reversed by making the second of the two sounds the more intense. Tactual stimuli were employed in the second experiment. The mutual relations between the distance and time interval separating the stimuli and their intensity and duration were studied. It was found that an increase in the distance between the two stimuli necessitates a correlative increase in the time interval or in the intensity of the stimuli in order to preserve the illusion. Likewise as the intensity or duration of the stimuli are increased, the interval must be decreased. The direction of the illusory movement can be reversed by making the second stimulus the more intense. The results harmonize with those of similar experiments in the field of vision. The similarity of the results for three different senses suggests an explanation in central terms. Wertheimer's hypothesis is discarded as inapplicable to the field of hearing. An explanation in terms of the action theory is suggested.

Ritter (5) studied the V-H illusion when the point of juncture of the two lines was fixated throughout a long exposure. She used the method of gradual adjustment performed by the experimenter at the dictation of the observer. Besides the usual vertical horizontal relations, comparisons were instituted between lines situated on eight meridians when their angular relation was varied. It was found that illusory disparities existed for any two meridians and that all were similarly affected by the variable conditions studied. It was thus concluded that the vertical horizontal illusion is but a special case of meridional disparities, all of which must be explained in the same manner. The character of these disparities varies with

the individual. Practice increases the illusions with some individuals and decreases them with others. The adjustment of the variable line operates to increase the apparent length of the standard line when placed in the opposite half of the visual field. The following factors were ineffective: astigmatism, ocular balance, head position, ocular position, bodily position, objective contour, and inequalities of illumination in different portions of the visual field. Attention to either line with constant fixation diminished its apparent magnitude. The relation of the illusion to the length of the lines was studied. By intercepting vision of the two lines for a certain distance from their point of juncture, judgments were obtained of the illusory disparity of two lines when peripherally perceived. By combining the results of these two tests, it was possible to estimate the relative influence of the foveal and peripheral portions of the retina in contributing to the illusion. It was found that the peripheral portions were the more effective, and that the foveal segment may tend to reverse the illusion. It is concluded that the illusions are due to attention which is conditioned in part by retinal factors and in part by eye movements.

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GRAPHIC FUNCTIONS

BY JUNE E. DOWNEY

University of Wyoming

Since the last review on this topic little has appeared that is new. Surveys of writing proficiency by means of the current scales are reported from time to time and are of service in standardizing handwriting requirements and in refining procedural technique. Ashbaugh (1) reports on the attainment in handwriting of Iowa school children; and Breed and Down (4) report for Grades III to

VI of the Highland Park, Michigan, schools. Breed and Down urge that each school should establish norms of achievement and should construct its own scale for measuring achievement.

Breed and Culp (3), continuing their investigation of the relation of legibility and form in handwriting, find that, of the five factors considered, letter-formation is most closely related to legibility; spacing is next; and uniformity of alignment, quality of line and uniformity of slant follow in the order mentioned. Legibility was determined by the speed-of-reading method and the factors for form were found measurable by Freeman's scale. Graves (12) reports on the relation of slant, spacing, arrangement, letter-size, and form of movement to legibility and to speed. Convenient schemes for tabulating data are presented. Some of the results of this investigation are rather unexpected; the high speed and legibility of back-slant, for example. This outcome must, however, be reviewed in light of the very small percentage of backhand writers in Graves' original group and the large deviation from the medium in the case of this subgroup. Interesting facts with reference to graphic instability are also brought out by Graves' tabulation. Manuel (13) in an interesting article suggests that the deterioration of forms in adult writing should be analyzed as a means of determining what modifications should be introduced into teaching practise, in the hope of rendering writing habits more permanent. "We could guard against the deterioration or else change the forms which we try to teach, making them from the first like they tend to become."

The report of cases of mirror-writing in ophthalmological journals suggests a point of departure not taken very seriously today, the reference, that is, of spontaneous mirror-writing to visual defect of some sort. Calhoun (7) states the present day attitude, gives a brief summary of the literature of the subject, and reports for the case he had under investigation that the child's vision was normal except for a small amount of hyperopia, that he showed some tendency toward the use of the left hand and was awkward with the right. Brown's report (5) on a colored boy emphasizes the pedagogical aspect of the case. Three years were needed to overcome the practise of mirror-writing. The "patient" has always written with his right hand although he has some of the habits of the left-handed child; vision is normal. Brown gives interesting reproductions of cipher characters and of script as copied by the child from the blackboard. All other forms of displacement as well as the

conventional mirror-forms occur. The boy in question was thought to be a dullard until his peculiarity of expression was discovered; at ten years, his work is average.

Fuller (10) presents a most instructive series of experiments on mirror-writing designed to test the author's theory as to the principal cause for mirror-writing. The spontaneous unpracticed writing of the left hand is reversed writing because of symmetrical accompanying movements for the two halves of the body. The infrequency with which mirror-writing is produced with the left hand is due to visual supervision. If disorganization through distraction of attention can be experimentally induced mirror-writing should result, for "crossed impulses will be free to function." Fuller tested the effect of dissociation in hypnosis, hysteria, drug-intoxication and found reversed writing a frequent occurrence but he was not successful in his attempt to induce mirror-writing by the use of a prism which reversed the visual field. Sudden spontaneous complete reversals are held to result from "organic or functional lesions having the nature of a dissociation." But besides automatic unpracticed mirror-writing two other forms of mirror-writing occur: (1) Deliberate controlled mirror-writing; and (2) Fragmentary reversals growing out of the confusion of lateral space-relationships and frequently appearing in the normal right-handed writing of children at a certain stage in development and in the writing of the unlettered.

An experiment on "Handwriting Disguise" is reported by Downey (8). The investigation sought to determine the graphic elements which were most frequently changed in intentional disguise and by this means to discover the specific effect upon handwriting of an unusually high degree of control. Striking individual differences in capacity to mask the hand were evident. Probably age and sex were slightly influential in determining ease or difficulty in disguise. Downey and Anderson (9) report considerable retention of power to write and read simultaneously after a cessation of practice for more than two years but with curious differences in the reactions of the two subjects.

The most significant production on the psychology of drawing in the period under consideration is that of Ayer (2). Ayer presents a most excellent survey of the existing literature on the psychology of drawing, a survey which is made to contribute to Ayer's chief purpose the study of drawing as a device in laboratory teaching. As one outcome of his experiments Ayer recommends the substi-

tution in laboratory teaching of description, memory drawing, and analytical drawing for representative drawing.

Some interesting reproductions of the pictorial art of the insane are furnished by Burr (6), who concludes from his study that such art is very largely representative of emotional states and complexes, and is often subtly symbolic.

George (11) analyzes with care the statement that the Arabs use gestures in affirmation and negation that are just the reverse of those with which we are familiar. He concludes that such a belief originated in a superficial and unscientific observation and that the gestures in question are among the Arabs similar to our gestures in the west.

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NOTES AND NEWS

At Northwestern University Dr. Robert H. Gault has been promoted to the professorship of psychology.

THE Federal Board for Vocational Education is publishing a monthly magazine, *The Vocational Summary*, which will contain articles and news on the vocational restoration of cripples as well as on the vocational training of normal individuals.

FROM the office of the Surgeon General of the Army there will be published a monthly magazine, *Carry On*, which is expected to circulate among those interested in the reëducation of disabled soldiers and sailors. The editor, Dr. Casey A. Wood, Major M.R.C., will be assisted by an editorial board and an advisory committee.

PROFESSOR G. M. WHIPPLE has resigned his position at the University of Illinois and accepted a professorship of applied psychology at the Carnegie Institute of Technology. At the same institution Professor J. B. Miner has been promoted to an associate professorship, and Dr. L. L. Thurstone to an assistant professorship. Dr. Kate Gordon has been given leave of absence for the fall quarter. Dr. Beardsley Ruml has been granted leave for the whole year, and Professor Thurstone and Dr. T. J. Kirby half time leave to work on Army problems.

PROFESSOR R. M. OGDEN, of Cornell University, delivered the commencement address at the University of Tennessee.

THE following items have been taken from the press:

AT Teachers College, Columbia University, leave of absence has been granted to Professor F. G. Bonser for the winter session of 1918-1919.

PROFESSOR EWALD HERING, the eminent physiologist, has died at the age of 84 years.

DR. BUFORD J. JOHNSON has resigned her position as assistant psychologist in the laboratory of Social Hygiene, Bedford Hills, N. Y., and has accepted an appointment as research assistant in the Bureau of Educational Experiments, New York City.

THE
PSYCHOLOGICAL BULLETIN

THE USE OF INTELLIGENCE TESTS IN THE ARMY

BY L. M. TERMAN

Stanford University

"The war will be won through a judicious expenditure of brain power rather than a stupendous expenditure of man power," General Crowder, in an interview quoted in the *Literary Digest*, September 14, 1918.

The Difference Between a Horde and an Army.—When Germany mobilized her army practically every man called to the colors had had two or more years of military training. In that time each man had demonstrated the type of work he was able to do and had been trained to do it. The army was already made. Each division had been organized to the last detail and supplied with its quota of trained officers, machine gunners, infantrymen, artillerymen, ammunition trains, bakers, cooks, teamsters, mechanics, chauffeurs, aviators, engineers, chemists, doctors, and labor battalions. The parts of the machine needed only to be assembled in order to begin work.

Contrast this situation with that in an American cantonment receiving each month perhaps twenty thousand men, from all walks of life, with every kind of training and experience, of all degrees of ability, and alike only in their universal ignorance of the science and art of modern warfare. Such a body of men is not an army; it is only the raw material for an army. It will only become an efficient army in proportion as each man is assigned to the kind of duty for which he is best fitted, and is trained in the performance of that duty. As long as it remains but an assembled horde, it could easily be vanquished by a trained army of a twentieth its size.

The Problem of Classification.—Before the horde can be trans-

formed into an army, two kinds of classification and selection are equally important and necessary: (1) on the basis of previous occupation, and (2) on the basis of mental ability. The former will be treated in a later chapter. The importance of selection on the basis of mental ability is enhanced by the fact that the majority of men who enter the army must be assigned to duties which have little in common with the occupations they have mastered in civil life. They must learn their new tasks from the beginning, and the speed with which they can do this will depend largely upon their intelligence. Some of these tasks require a high degree of intelligence for rapid mastery, others relatively little. Hence, the necessity of some kind of intellectual sifting. The general purpose of such sifting is two fold: (1) to aid in placing each man where his military usefulness will be greatest, and (2) to reduce the time necessary for organizing and training units.

Mental Tests for Millions.—The preceding chapter has shown us that the ideal way to bring about such a mental classification is by means of intelligence tests. Immediately after the declaration of war by the United States the President of the American Psychological Association appointed a "Committee on the Psychological Examination of Recruits." This committee decided to recommend the mental examination of every soldier, and within six weeks had prepared methods adequate for the huge task of testing millions of men.

The intelligence scale devised for the purposes embodied the following important features:

1. It permitted "group examining" so that one examiner could test several hundred men in less than an hour.
2. The procedure in giving the tests was so minutely laid down that anyone of a hundred examiners testing a group would get the same results.
3. The test questions were ingeniously arranged so that practically all could be answered without writing, by merely drawing a line, crossing out or checking.
4. By the use of scoring stencils the personal equation was entirely eliminated from the grading of papers. When the stencil is placed upon the paper it shows instantly the number of correct answers. The test papers are in fact scored by enlisted men who know nothing about psychology.
5. Coaching was guarded against by making five different "forms" of the scale, each "form" differing entirely in substance

from every other "form," yet all exactly equal in difficulty and alike psychologically.

After a preliminary trial of the tests on 4,000 soldiers they were adopted for use and further trial in four National Army Cantonnements. By January, 1918, some 80,000 men and officers had been tested. An official investigation of the results in these four camps indicated such large value for the psychological work that it was ordered extended to include the testing of the entire enlisted personnel of the Army. At the same time a Division of Psychology was established in the Office of the Surgeon General, commissioned officers were provided to carry out the program, and a School of Military Psychology for the training of Psychological Officers was established at Fort Oglethorpe, Georgia. By October 1, 1918, approximately one and a half million men and officers had been tested and classified according to intelligence, and tens of thousands of assignments or promotions had been made wholly or in part on the basis of the intelligence ratings. Intelligence ratings have proven of military value in the following particulars:

1. In the discovery of men whose superior intelligence recommends their advancement.
2. In the prompt selection and assignment to Development Battalions of men who are so inferior mentally that they would retard the training of other soldiers.
3. In forming organizations of uniform mental strength where such uniformity is desired.
4. In forming organizations of superior mental strength where such superiority is demanded by the nature of the work to be performed.
5. In selecting suitable men for various army occupations or for special training in colleges or technical schools.
6. In eliminating from the army those men whose low grade intelligence renders them either a burden or a menace to the service.

Three Systems of Tests.

The general intelligence tests as used in the U. S. Army include three types.

1. *Alpha*, a group test for men who read and write English. The Alpha test measures a man's ability to comprehend, to remember and follow instructions, to discriminate between relevant and irrelevant answers to common sense questions, to combine related ideas into a logical whole, to discover by logical reasoning the plan

present in a group of abstract terms, to keep the mind directed toward a goal without yielding to suggestion, and finally, to grasp and retain miscellaneous items of information. It is so arranged that its 212 questions are answered by checking or underlining, thus permitting the answers to be scored by the use of stencils.

2. *Beta*, a group test for foreigners and illiterates. The Beta test is given to all men who cannot understand or read English well enough to take the Alpha test. Success in it does not depend upon knowledge of English, as the instructions are given entirely by pantomime and demonstration. Like Alpha, Beta measures general intelligence, but it does so through the use of concrete materials instead of by the use of written language. It measures particularly the ability to understand instructions given in pantomime, degree of foresight and ingenuity, the ability to discover a plan in given materials, the power to form arbitrary associations quickly, the ability to find likenesses and differences among printed symbols, to detect absurdities, to remember, and to combine related items into a logical whole. Like Alpha, its answers require no writing and are scored by stencils.

3. *Individual Tests*.—Three forms of individual tests are used in the examination of men who fail to pass the group tests. They are The Yerkes-Bridges Point Scale, The Stanford-Binet Scale, and The Performance Scale. The Performance Scale was devised especially for testing foreign subjects. The instructions are given by signs and demonstration, and a high score may be earned by one who does not know a word of English.

Procedure

All enlisted men are given either Alpha or Beta according to their degree of literacy. Those who fail in Alpha are given Beta, and those who fail to pass either of the group tests are given an individual test. Of whites, ordinarily about 75 per cent. receive their ratings on Alpha, about 20 per cent. on Beta, and only about 5 per cent. on an individual test. However, recommendation for rejection, discharge, or assignment to development battalion is not made on the result of a group test alone, but only after an individual test. This is a necessary precaution to prevent malingering.

Each group test takes a little less than an hour and can be given equally well to any number of men up to four or five hundred, according to available space. The individual test ordinarily takes from fifteen to thirty minutes, though in difficult cases an hour is occasionally necessary.

In all the examinations the greatest care must be taken to keep the conditions uniform, to put the men at their ease, and to encourage them to do their best. In this there is rarely any difficulty. Experience shows that the men take the test seriously but without undue nervousness. Attempts to cheat are not common.

Ratings

As a result of the tests each man is rated as A, B, C, C—, D—, D or E. The letter ratings of all the men are reported to the Personnel Office, are there copied on the qualification cards, and are then given to company commanders.

What the Letter Ratings Mean.—The rating a man earns furnishes a fairly reliable index of his ability to learn, to think quickly and accurately, to analyze a situation, to maintain a state of mental alertness, and to comprehend and follow instructions. The score is little influenced by schooling, for some of the highest records have been made by men who had never even finished the eight grades. The meaning of the mental ratings is as follows:

A. *Very Superior Intelligence.*—This grade is earned by only four or five soldiers out of a hundred. The "A" group is composed of men of marked intellectuality. "A" men are of high officer type when they are also endowed with leadership and other necessary qualities.

B. *Superior Intelligence.*—"B" intelligence is superior, but less exceptional than that represented by "A." The rating "B" is obtained by eight to ten per cent. of soldiers. The group contains a good many men of the commissioned officer type and a large amount of men of non-commissioned officer material.

C+. *High Average Intelligence.*—This group includes about fifteen to eighteen per cent. of all soldiers and contains a large amount of non-commissioned officer material with occasionally a man whose leadership and power to command fit him for commissioned rank.

C. *Average Intelligence.*—Includes about twenty-five per cent. of soldiers. Excellent private type with a certain amount of fair non-commissioned officer material.

C—. *Low Average Intelligence.* Includes about twenty per cent. While below average intelligence, "C—" men are usually good privates and satisfactory in work of routine nature.

D. *Inferior Intelligence.*—Includes about fifteen per cent. of soldiers. "D" men are likely to be fair soldiers, but are usually slow in learning and rarely go above the rank of private. They

are short on initiative and so require more than the usual amount of supervision. Many of them are illiterate or foreign.

D— and E. *Very Inferior Intelligence*.—This group is divided into two classes (1) “D—” men, who are very inferior in intelligence but are considered fit for regular service; and (2) “E” men, those whose mental inferiority justifies their recommendation for Development Battalion, special service organization, rejection, or discharge.

The immense contrast between “A” and “D—” intelligence is shown by the fact that men of “A” intelligence have the ability to make a superior record in college or university, while “D—” men are of such inferior mentality that they are rarely able to go beyond the third or fourth grade of the elementary school, however long they attend. In fact, most “D—” and “E” men are below the “mental ages” of ten years and at best are at the border-line of mental deficiency. Most of them are of the “moron” grade of feeble-mindedness. “B” intelligence is capable of making an average record in college, “C+” intelligence can not do so well, while mentality of the “C” grade is rarely equal to high school graduation.

Evidence that the Tests Measure a Soldier's Value to the Service.—It has been demonstrated that the intelligence ratings are very useful in indicating “soldier value.” Such evidence as the following is typical:

1. Commanding officers of ten different organizations representing various arms in a camp were asked to designate: (a) The most efficient men in the organization; (b) Men of average value; (c) Men so inferior that they were “barely able” to perform their duties.

The officers of these organizations had been with their men from six to twelve months and knew them exceptionally well. The total number of men rated was 965, about equally divided among “best,” “average,” and “poorest.” After the officers’ ratings had been made, the men were given the psychological tests. Comparison of test results with officers’ ratings showed:

(a) That in every organization except one, the average score of the “best” group was approximately *twice* as high as the average score of the “poorest” group.

(b) That of men testing below C—, 70 per cent. were classed as “poorest” and only 4.4 per cent. as “best”;

(c) That of men testing above C+, 15 per cent. were classed as “poorest” and 55.5 per cent. as “best.”

(d) That the man who tests above C+ is about fourteen times as likely to be classed "best" as the man who tests below C-.

(e) That the per cent. classed as "best" in the various letter groups increased steadily from 0 per cent. in D- to 57.7 per cent. in A, while the per cent. classed as "poorest" decreased steadily from 80 per cent. in D- to 11.5 per cent. in A.

Many investigations of this kind have been made, and always with results similar to those just quoted. Considering that the low value of a soldier may have many other causes besides inferior intelligence, such findings are very significant.

2. Where commissioned officers have been selected on the basis of trying out and "survival of the fittest" it is ordinarily found that about 80 per cent. are of the A or B grade, and only about 5 per cent. below the C+ grade. Of non-commissioned officers chosen by this method, about 75 per cent. are found to grade A, B, or C+, and only 5 per cent. below C. Moreover, there is a gradual rise in average score as we go from privates up through the ranks of privates first class, corporals, sergeants, sergeants first class, O.T.S. students, and commissioned officers. This is seen in the following table:

PER CENT. EARNING EACH LETTER RATING

Various Groups (Whites)	D or E	D	C-	C	C+	B	A	A and B
8,819 commissioned officers	0.0	0.01	.25	2.92	13.8	34.6	48.4	83.
9,240 O.T.C. candidates..	0.0	0.14	.98	6.16	19.5	36.4	36.8	73.2
3,393 sergeants.....	0.0	1.05	4.05	14.2	27.3	32.5	20.9	53.4
4,023 corporals.....	0.0	1.33	7.33	20.33	31.3	26.	13.7	39.7
81,114 literate privates...	0.22	10.24	21.48	28.79	20.48	12.38	6.37	18.75
10,803 illiterate privates..	7.8	41.16	29.11	14.67	4.43	1.95	.52	2.47

3. Experience shows that "D" students admitted to Officers' Training Schools almost never make good, and that the per cent. of elimination among the "C-" and "C" students is several times as high as among "A" students. For example, in one of the Fourth Officers' Training Schools 100 per cent. of the "D" men were eliminated as unsatisfactory, 55 per cent. of the "C-" men, 14.8 per cent. of the "B" men, but only 2.7 per cent. of the "A" men. In another Fourth Officers' Training School 76.2 per cent. of the men rating below C were eliminated in the first six weeks, 51.5 per cent. of the "C" men, and none at all of the "A" or "B" men. These findings are typical.

The psychological ratings are valuable not so much because they make a better classification than would come about in the course of

time through natural selection, but chiefly because they greatly abbreviate this process by indicating *immediately* the groups in which suitable officer material will be found, and at the same time those men whose mental inferiority warrants their elimination from regular units in order to prevent the retardation of training. Speed counts in a war that is costing our country over fifty million dollars per day.

Directions for the Use of Intelligence Ratings.—The following instructions for the use of the intelligence ratings have been issued to the Personnel Adjutant of each camp:

1. The mental tests are not intended to replace other methods of judging a man's value to the service. It would be a mistake to assume that they tell us infallibly what kind of soldier a man will make. They merely *help* to do this by measuring one important element in a soldier's equipment; namely, intelligence. They do not measure loyalty, bravery, power to command, or the emotional traits that make a man "carry on." However, in the long run these qualities are far more likely to be found in men of superior intelligence than in men who are intellectually inferior. Intelligence is perhaps the most important *single* factor in soldier efficiency.

2. Commissioned officer material is found chiefly in the A and B groups, although of course not all high score men have the other qualifications necessary for officers. Men below C+ should not be accepted as students in Officers' Training Schools unless they are known to have exceptional power of leadership and ability to command.

3. Since more than one fourth of enlisted men rate as high as C+, there is rarely justification for going below this grade in choosing non-commissioned officers. This is especially the case in view of the likelihood of promotion from non-commissioned to commissioned rank. Even apart from considerations of promotion, it is desirable to avoid the appointment of mentally inferior men (below C) as non-commissioned officers. Several careful studies have shown that "C—" and "D" sergeants and corporals are extremely likely to be found unsatisfactory. The fact that a few make good does not justify the risk taken in their appointment.

4. Men below C+ are rarely equal to complicated paper work.

5. In selecting men for tasks of special responsibility the preference should be given to those of highest intelligence rating *who also have the other necessary qualifications*. If they make good they should be kept on the work or promoted; if they fail they should be replaced by men next on the list.

To aid in selecting men for occupational assignment, extensive data have been gathered on the range of intelligence scores found in various occupations. This material has been placed in the hands of the Personnel Adjutants for use in making assignments. It is suggested that as a rule, a man should not be assigned to an important army occupation unless his intelligence rating is as high as the average for all men in that occupation.

6. In making assignments from the Depot Brigade to permanent organizations it is important to give each unit its proportion of superior, average, and inferior men. If this matter is left to chance there will inevitably be "weak links" in the army chain.

Exception to this rule should be made in favor of certain arms of the service which require more than the ordinary number of mentally superior men; *e. g.*, Signal Corps, Machine Gun, Field Artillery and Engineers. These organizations ordinarily have about twice the usual proportion of "A" and "B" men and very much less than the usual proportion of "D" and "D—" men.

7. "D" and "D—" men are rarely suited for tasks which require special skill, resourcefulness or sustained alertness. It is also unsafe to expect "D," "D—" or "E" men to read or understand written directions.

8. Only high score men should be selected for tasks that require quick learning or rapid adjustments.

9. It should not be supposed that men who receive the same mental rating are necessarily of equal soldier worth. *A man's value to the service should not be judged by his intelligence alone.*

10. It is one of the most important functions of the psychological tests to aid the Personnel Office in the rapid sorting of the masses of men in the Depot Brigade. *In no previous war has so much depended on the prompt and complete utilization of the mental ability of the individual soldier.* It is expected, therefore, that the psychological ratings will be regularly used as an aid in the selection, assignment, and classification of men.

PROBLEMS

1. Has there ever been another war in which so much depended on the prompt and complete utilization of the intelligence of the individual soldier?

2. Does it seem unreasonable to believe that the best possible use of every soldier's ability might hasten by several months the country's attainment of maximum military efficiency? Assuming

for a basis of discussion that it would make a difference of three months, indicate the possible value of such a saving of time in terms of war costs and chances of making the victory complete.

3. In view of the fact that one fourth of the privates in an average unit test as high as C+, B, or A, what would be the probable effect of having 40 per cent. of the non-commissioned officers of a grade below C? (An actual situation.)

4. What are the relative values of the following qualities in an officer's equipment:

Muscular strength and agility;

Size;

Physical bearing;

Voice;

Leadership;

Character;

Intelligence.

Which of the first six traits are most likely to be associated with superior intelligence?

5. A camp Personnel Officer is asked to supply 100 auto mechanics. Examination of the files of the Qualification Cards shows that there are 360 men in the camp classified as auto mechanics, with intelligence ratings as follows:

D-	D	C-	C	C+	B	A
4	21	53	98	107	58	17

How would you select the men for assignment? (Personnel Adjutants are constantly faced with such problems in selecting men for army occupations.)

6. Show the value of a certain amount of leveling up of units. Suppose the defense of an important sector has been entrusted to a regiment which is made up largely of "D" and "D-" men. What would probably happen in case of an offensive by the enemy?

How would you treat such inequalities in mental strength as are shown in the following "best" and "poorest" companies of a Depot Brigade?

	D- or E	D	C-	C	C+	B	A
Best	0%	4%	5%	21%	28%	26%	16%
Poorest	4%	19%	18%	29%	19%	9%	2%
			Best	Poorest			
Grades below C-,			4%	23%			
Grades above C+,			42%	11%			

7. Is it fair to judge a company commander entirely by the results he gets? How would this rule work in the two companies mentioned above?

8. Show various ways in which a feeble-minded soldier may be a burden to the service and a menace to his fellows.

9. Of 1,059,767 soldiers who were given a psychological examination between May 1 and September 1, 1918, 16,266 had a "mental age" of 8 years or less, and 7,359 a "mental age" below 7 years. Many men of this grade of mentality are so nearly normal in appearance that without an intelligence test, their mental deficiency would long escape detection. Try to estimate the total menace this many feeble-minded soldiers would constitute.

10. Assume that it costs \$2,500 to induct a soldier into the service, equip him, train him for eight months, and send him overseas; assume also that if he must then be returned as unfit, the government will be put to a further expense of \$2,500 in sending him home, mustering him out, and meeting insurance or pension obligation until his case is closed. On this basis, compute the money wasted by accepting 10,000 soldiers too inferior mentally to be used. Compare the total with the cost of giving intelligence tests to a million recruits at 25 cents per man.

HOW THE ARMY USES INDIVIDUAL DIFFERENCES IN EXPERIENCE¹

BY VARIOUS MEMBERS OF THE COMMITTEE ON THE CLASSIFICATION OF PERSONNEL IN THE ARMY.

The Headquarters Company of a 3-inch Field Artillery Regiment contains 187 enlisted men. Twenty-six of these are privates, first class. They are listed in Tables of Organization as follows: 1 in charge Regimental Commander's Scissors Instrument, 3 telephone operators, 9 scouts, 9 radio operators, 3 chauffeurs, 2 operators Battalion Commander's Scissors Instrument, 2 signalers.

An analysis of the work that these privates, first class, have to do shows that the first one must have had some experience as a draftsman, principally as a detailer; the next three must have had some experience in repairing telephone switchboards and be able to operate such a switchboard; three of the nine scouts must have

¹ Outlines of the Study of Human Action for the Students' Army Training Corps, Section 2.

had some experience as general electricians; the six radio operators must have had a good deal of experience as wireless operators; the three chauffeurs must be capable of handling light trucks; and the next two in the list must have had some experience as draftsmen—as detailers. Eighteen out of the twenty-six must be specially trained men. The remainder need not be specifically considered as the work that they must do can be learned relatively quickly by the average man, or is not a type of work that is learned by anyone in civil life.

Supposing that you were called upon to organize such a company as the above, how would you set about it? Let us consider three possibilities. If 187 enlisted men had already been assigned to your company, you might pick out 26 of them at random and start training them for these special positions. The disadvantages of such a course are obvious. First, there must be competent teachers for all these different tasks. Second, it would delay the organization of the company from three months to two years until the necessary training had been acquired. Third, after waiting all that time one of the men might be found unfit for the task, might be taken sick or die.

A more reasonable way of organizing the company would be to find out which men had had some experience in these various directions. But then perhaps the most exacting job would be left unprovided for. So the delay might be almost as serious in this case as in the first. The whole company would be held up until its organization was complete.

A third plan might be to select from the total number of men available in any camp just the men whose training and experience fitted the needs of your company.

Obviously this would be the most efficient plan. It saves time and money. It saves teachers and school facilities. More than all that it tends to place each man where he will be most at home, where he will feel that he as an individual is being of the greatest service in our great national task.

If you multiply the task of organizing this headquarters company of artillery by twenty-five thousand you will have a fair estimate of the personnel problems of organizing an army of 5,000,000.

For forty years the German Army had been organizing. Each man in it had been trained to do just the task that was expected of him in war. They were thoroughly drilled in the school of the

soldier, squad, company, etc., and in addition they were good draftsmen, wireless operators, electricians, chauffeurs, etc., just in the right proportion. All were assigned to the precise commands where they were needed.

In America there was nothing even remotely resembling such an organization of our civil population for war purposes. Under the urgent necessity of creating an organized army in the shortest possible time every scrap of training or experience that was needed by the Army was a national asset, if it could be found and correctly placed. Practically none of the men coming into the army had had military training so that had to be provided for all. But of the enlisted or selective service men, many had had more or less experience in many trades and professions that were needed somewhere by the army.

To discover these invaluable bits of specialized human experience and training—to catalogue and classify them—to make them available where they were most needed in the organization of the national army—that was a new and as our enemies thought a hopeless task.

It is solved in the following manner: (1) Every enlisted man is interviewed as he comes into the army and his educational, military and occupational history is recorded on a Qualification Card (see illustration). (2) The needs of each organization in the army are studied to determine just what kind of men coming from civil life will most quickly learn the new duties to be performed in that organization. (3) On the basis of such needs and the soldier's Qualification Cards, a Personnel Officer in each camp assigns the new men to their proper organization in the local camp. (4) Since various camps are oversupplied with certain types of men, such as miners from Pennsylvania or lumbermen from Washington, and undersupplied with other specialists, reports are made to Washington and these men are assigned from one camp to another in terms of the total supply and demand of the army. (5) A similar system has been established for the proper assignment of officers. It is now well recognized in France that an officer may be a complete failure in one unit and at one kind of work and become a great success when assigned to a different type of work. There they have effected an organization whereby only recently 2,200 officers who formerly would have been discharged and sent home have been reassigned with every expectation that they will make good.

The Soldier's Qualification Card.—The Qualification Card is the

1-75-1918
 Name: **Kellogg**
 Priv. Geny: **John**
 Main: **John**
 Occupation: **Timber & Concrete Construction Foreman**
 Just what did you do? **Best, heavy timber work and concrete construction, bridges, with washburn, etc.**
 Name of firm worked for? **A. J. Smith Construction Co**
 Dept., Shop or Branch? **Chicago**
 Address of firm? **528-11th St. Chicago**
 Checked once ✓ occupations in which he has some knowledge and ability; checked twice ✓ occupations at which he is skilled. After each checked occupation write number of years of experience. Put a circle around years of minor concurrent occupation.
 1 Factory worker.....
 2 Farmer.....
 3 Lumberman.....
 4 Lawyer, teacher.....
 5 Business man.....
 6 Machinist.....
 7 Blacksmith.....
 8 Conductor.....
 9 Concrete worker.....
 10 Electrician.....
 11 Gunsmith.....
 12 Painter.....
 13 Plumber.....
 14 Pipe fitting man.....
 15 R. & E. operating man.....
 16 Road worker.....
 17 Telephone operator or repairman.....
 18 Stockkeeper.....
 19 Sheet metal worker.....
 20 Foundryman.....
 21 Lumberman.....
 22 Chauffeur-auto.....
 23 Chauffeur-truck.....
 24 Auto mechanic.....
 25 Gasoline engine repairer.....
 26 Bricklayer.....
 27 Horse, care of.....
 28 Farrier, veterinarian.....
 29 Craftsman.....
 30 Carpenter.....
 31 Telegrapher, in-cluding wireless.....
 32 Lineman.....
 33 Telephone operator or repairman.....
 34 Photographer, still or moving.....
 35 Lumberman.....
 36 Boatman, mariner.....
 37 Accountant.....
 38 Clerical worker.....
 39 Stenog., typist.....
 40 Stenog., cook.....
 41 Butcher.....
 42 Merchant, job'r, wholesaler.....
 43 Medical man.....
 44 Band musician.....
 45 Printer.....
 46 Leather worker.....
 47 Tailor.....
 48 Tinsmith.....
 49 Construction foreman, brick or iron.....
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 244 Construction foreman, brick

51 **SCHOOLING** No. of graduated years Yes No Army Training School Certificate, etc.

Common school	8	✓	
High school	4	✓	
Trade, Night or Business school	1		
College or University			
Technical College			

Name of College, Univ. or Technical College attended U. W. C. O. Night School Age at end of schooling 19

Can you carry on a conversation in French? No In German? Yes 53

In any other languages? No (Name them) 54

MILITARY EXPERIENCE
Outline any previous military experience you have had, giving rank, years of service, and organization:

1 year, National Guard, Chicago, Corp.

Branch of service or special duty preferred Engineer
GENERAL

Religious preference (Denomination)? Presby. Union
Answer requested but not required

Member of what fraternal, etc., organizations? Elks, Carpenter Union

Talent for furnishing public entertainment

Play mandolin

Birthplace Chicago, Ill. How long in U. S.? 30 yrs.
Give city and State of U. S. or Province and Name of Foreign Country

of Father Wm. H. H. H. of Mother London, England

Citizen. ☒ Taken out first papers, ☐ Non-citizen. ☐ Check one.

From Local Board 17 Chicago Ill.

No. 383 Red Ink No. 183 Town, City or County Chicago Army Serial No. 1,297,383

Signature of soldier John T. Hellogg

Signature of interviewer Paul T. Smith

Date 3/12/18 Rank Capt Inf R.C.

PRESENT ASSIGNMENT AND FUTURE CHANGES

Company	Organization	Arm	Division	Date
1 <u>B</u>	<u>311</u>	<u>Eng.</u>	<u>86</u>	<u>3/12/18</u>
2				
3				
4				
5				

REMARKS

basis of all personnel work in the army. Two different forms are used, one for officers and the second for soldiers. The card for soldiers is reproduced here. The other is similar.

This is not the place to enter into a detailed discussion of the soldier's Qualification Card. It is expected that a soldier who interviews recruits and makes out their cards will have received extensive instruction on the subject and will become familiar with most trades and their subdivisions together with the work performed by each. The subdivisions recognized in the army are given in an Index of Occupations issued by the War Department with a code symbol for each. For example, "Telephone man" is subdivided as follows:

Engineer.....	33 e
Operator.....	33 o
Switchboard installer.....	33 si
Switchboard repairman.....	33 s
Telephone installer	33 te
Troubleman, inside.....	33 t
Troubleman, outside.....	33 to
Wire chief.....	33 w

After the Qualification Card has been made out and checked it is turned over to a classifier who appraises the card and estimates how good the man is at each occupation and determines at which occupation the man should preferably be used. He marks the card accordingly. A tabber then affixes small celluloid tabs along the top of the card to represent the experience of the recruit. An orange tab placed at 6 indicates an apprentice machinist, a green tab placed at 6, represents a journeyman machinist. If the man is a journeyman at more than one trade, for example, as a machinist and a bricklayer, then a green tab is used at 6 because a machinist is more needed in the army than a bricklayer. But a black tab is placed 26 for bricklayer so that he may be found if he is needed.

After the cards have been tabbed, they are filed alphabetically by companies. When a requisition is received, say for experienced wireless operators, a file clerk looks down the cards of men available for transfer and notes each card which is green tabbed at 31. Only those cards are finally selected, however, which show that the men are wireless operators. Telegraphers and wireless constructors whose cards are also tabbed at 31 are saved for other requisitions. In this way men are located for every army need, providing trained men are available at any camp in the United States.

Tables of Army Occupational Needs.—Reference has already been made to the fact that the needs of each organization in the army are worked out so as to show just what kind of men in terms of civilian experience will learn the special duties of that organization in the shortest time. As an illustration the needs for the sappers and bombers platoon of the headquarters company of an infantry regiment are shown here. The code symbols refer to the Index of Occupations, previously mentioned.

SAPPERS AND BOMBERS PLATOON
HEADQUARTERS COMPANY INFANTRY REGIMENT

Table of Organization	Table of Corresponding Civilian Occupations		
Army Title	Number		Civil Occupation and Classification Symbol
	Jour- neyman (Green) Tab	Appren- tice (Orange) Tab	
3 Sergeants (Bombers) ¹	I		Construction Foreman (50 ea) or Mine Foreman (12 f)
7 Corporals			
1 Sappers Section			
6 Bombers Section ¹		II	Miner (12 b, p, g)
11 Privates, 1st Class (Bombers Section) ¹			
27 Privates			
8 Sappers Section		I	Timberman (12 t)
		7	Digger (12 d) or Laborer (3)
		2	Brick or Stone Mason (26 s or g)
19 Bombers Section ¹			
Total	I	2I	22 Occupational Specialists 3 Others, leadership material 23 Not specified
48 Total enlisted			48 Total enlisted

¹ For 3-inch Stokes Mortars, Sergeants and Corporals should be men of mechanical aptitude; Privates, of superior strength and endurance.

Assignment.—1. Using the illustration of a Soldier's Qualification Card as a basis, interview a student and write up the interview as well as you can in the absence of a card upon which to record your data.

2. Using the Sappers and Bombers Platoon Table as a guide, prepare a Table of Occupational Needs for a Rifle Company in which you are now drilling. The Table of Organization for such a company calls for the following:

- 1 1st Sergeant
- 1 Mess Sergeant
- 1 Supply Sergeant
- 12 Sergeants
 - 4 Asst. to Platoon Commanders
 - 4 Riflemen
 - 4 Automatic Riflemen
- 33 Corporals
 - 1 Company Clerk
 - 8 Automatic Riflemen
 - 8 Bombers
 - 8 Rifle Grenadiers
 - 8 Riflemen
- 4 Cooks
- 4 Mechanics
- 2 Buglers
- 64 Privates, 1st Class
 - 4 Agents and Signalmen
 - 16 Automatic-Rifle Gunners
- 128 Privates
 - 16 Runners
- A total of 250 enlisted men.

TRADE TESTS

The qualification card as an index of fitness for any specialized task in the Army has one limitation as obvious as it is serious. Namely, the reports of men as to their degree of expertness in different trades is not always reliable. Some few recruits intentionally misrepresent their skill for the sake of getting a desirable place. Many lack proper standards of comparison. Perhaps the most obvious way to test a man's ability would be to take each man's statement at par and try him out for a month, raising or lowering his rating as a result of his performance. But this course would be enormously costly. Valuable machinery might be wrecked, lives might be lost. But even if there were no more tragic consequences the organization of an efficient army would be delayed and an inexcusable expense would be incurred.

The Personnel Office must handle and classify a constant stream of newly-enlisted men—sometimes over a thousand a day. Unless this office is willing to take a man's word or the record of his expe-

rience as sufficient evidence of his skill then some form of trade test is a necessity.

The idea of testing trade efficiency by examination is not new. Examinations of candidates for positions are given by firms, by professional boards, by Civil Service Commissions, etc. The use of trade tests to supplement the data of the qualification card differs from these familiar examinations, first, in the enormous variety of the trades, and secondly, in the quickness with which the tests must be applied.

When the problem of formulating tests was analyzed, it was seen that certain requirements were fundamental. A good trade test: (1) Must differentiate between the various grades of skill; (2) Must produce uniform results in various places and in the hands of individuals of widely different characteristics; (3) Must consume the least amount of time and energy consistent with satisfactory results.

While there are all degrees of trade ability among the members of any trade, it is convenient to classify them in a few main groups. Ordinarily the terms Novice, Apprentice, Journeyman and Journeyman Expert (or Expert) are employed. The Novice is a man who has no trade ability whatever, or at least none that could not be paralleled by practically any intelligent man. The Apprentice has acquired some of the elements of the trade but is not sufficiently skilled to be entrusted with any important task. The Journeyman is qualified to perform almost any work done by members of the trade. The Expert can perform quickly and with superior skill any work done by men in the trade.

It is sometimes desirable that the Trade Test should differentiate between the skill of different members of the same group; for instance, the journeyman group. It is essential that it should differentiate between the journeyman and the apprentice, and the apprentice and the novice. Trade tests devised to make this classification are of three kinds: oral, picture and performance.

The oral tests are most generally used because they are of low cost and they may be applied to a large number of men in a comparatively short time and without much equipment. They are satisfactory in determining the presence or absence of trade ability and in many instances determine the degree of ability with such accuracy that no other tests are required.

An oral Trade Test is developed by passage through twelve stages: (1) Priority, (2) assignment, (3) inquiry, (4) collection, (5) compilation, (6) preliminary sampling, (7) revision, (8) for-

mulation, (9) final sampling, (10) evaluation, (11) calibration, (12) editing.

Collecting the Trade Information.—From time to time the Personnel Organization of the Army submits to the Central Trade Test Office (Newark, N. J.) a list of trades which are required in Army use and for which tests are urgently needed. Upon the basis of this list, assignments are made to the field staff.

The field staff then makes thorough inquiry into the conditions of the trade. Their purpose is three-fold:

1. To determine the feasibility of a test in this trade. It was found, for example, that the trade of gunsmith was not a recognized trade, though there were gun repairers.

2. To determine the elements which require and permit of testing. In other words, can men be graded in it according to degrees of skill? In some trades it was found that the trade required simply the performance of a single set of operations and there were no gradations among the members of the trade.

3. To determine the kinds of tests that can be used. Some trades, such as truck driving and typewriting, are mainly matters of skill and for them performance tests are better than oral tests. Other trades, such as interior wiring and power plant operation, are mainly matters of knowledge. For these trades oral and picture tests are best.

After having discovered by inquiry that the trade is a recognized trade and can be tested, the field staff proceeds to collect all the information necessary from all available sources; for example, experts of the trade, trade union officials, literature of the trade, trade school authorities, employers and the like. They discover by this means what are the elements of the trade and what constitutes proficiency in it.

Compiling the Questions.—As a result of this collection of information they compile a number of questions, usually forty to sixty, each of which calls for an answer that shows knowledge of the trade. Experience in the formulation of such questions has shown that a good question meets the following requirements:

1. It must be in the language of the trade.
2. It must be a unit, complete in itself and requiring no explanation.
3. It must not be a chance question which could be answered by a good guess.
4. It must be as short as possible and must be capable of being answered by a very short answer.

5. It must not be ambiguous; the meaning must be unmistakable.

After the large number of questions originally formulated has been sifted down by application of these requirements they are used in a preliminary sampling on a number of tradesmen whose answers indicate the merits of the different questions and their grades from easy to difficult. In this sampling, tradesmen from different shops or plants are tried, in order to guard against specialized methods or modes of expression confined to a single locality. At least two examiners work on each set of questions at this stage to get the benefit of more than one point of view for revision.

This preliminary sampling affords a means of checking on the following points:

1. Is the test applicable to trade conditions?
2. Does the test represent good trade practice?
3. In what way can parts be profitably modified, supplemented or eliminated?
4. Does the test represent the whole range of the trade from the novice to the expert?
5. Is it a representative sampling of the whole range of trade processes?

In the light of the answers to these questions, the test is revised and is then ready to be formulated.

Final Sampling.—Final sampling is made by testing twenty men who are known to be typical representatives of each group (novice, apprentice, journeyman, expert). Among the novices tested are some highly intelligent and mature men of good general knowledge but no trade ability. Examinations are given to men whose record in the trade is already known and who are tested as nearly as possible in the same manner as men in the camps.

The results of this final sampling are now turned over to the Statistical Department of the Central Trade Test Office. The experts in this department make a careful study of the results and of the answers to each question. This enables them to determine the relative value of each individual question and the selection that makes a proper balance.

Evaluating the Test.—If a Trade Test is good, a known expert, when tested, is able to answer all, or nearly all, the questions correctly; a journeyman is able to answer the majority; an apprentice a smaller part, and a novice practically none. This does not mean that each question should be answered correctly by all the experts,

a majority of the journeyman, some apprentices but no novices. There are few questions which show this result. A graphic curve when plotted for such a question is almost a straight line (see Fig. 1, question 11).

Other types of questions, however, are more common. Some show a distinct line of cleavage between the novice and the apprentice. Novices fail, but apprentices, journeymen and experts alike

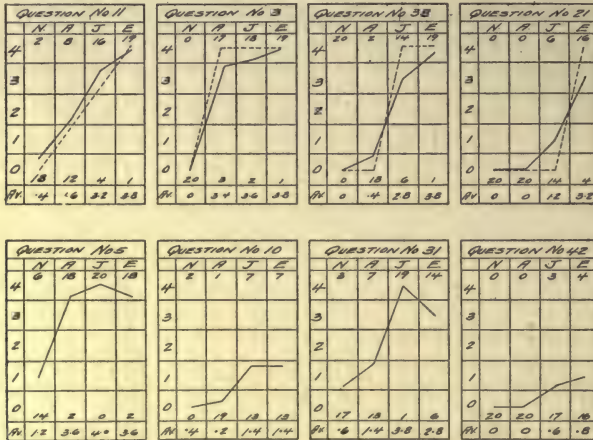


FIG. 1

This chart shows graphic representations of four good questions and four rejected questions. All are taken from the test shown in Fig. 2.

The dotted lines indicate ideal types; the solid lines show the questions as actually found in this test.

Question 11 approximates a gradual differentiation of groups.

Question 3 is a "Trade" Question, differentiating rather sharply between Novice and Tradesman.

Question 38 is an "Apprentice-Journeyman" Question, differentiating sharply between Novice and Apprentice on one hand and Journeyman and Expert on the other.

Question 21 is an "Expert" Question, its most marked differentiation being between Journeyman and Expert.

Question 5 is a poor trade question, Novices scoring high and Experts relatively low.

Questions 10, 31, and 42, are also poor questions which were finally rejected.

answer correctly. There are likewise questions that are answered correctly by nearly all journeymen and experts but only a few apprentices, and questions that only an expert can answer correctly (see Fig. 1, questions 3, 38 and 21).

Each type of question has its value in a good test. The main requirement is that the tendency of the curve should be upward; a question which is answered correctly by more journeymen than experts or more apprentices than journeymen is undesirable and is at once discarded. A proper balance is made of the others.

Calibrating the Test.—One task still remains; namely, that of calibrating the test. As each question is allowed four points, it becomes necessary to determine how many points should indicate an expert, how many a journeyman, etc. Obviously the way to do this is to note how many points were scored by the known experts and the known journeymen when they were tested. Ordinarily the expert scores higher than the journeyman and the journeyman higher than the apprentice. It frequently happens that a few journeymen score as high as the lowest of the experts and a few apprentices as high as the lowest of the journeymen. There are consequently certain overlappings between the classes (see Fig. 2).

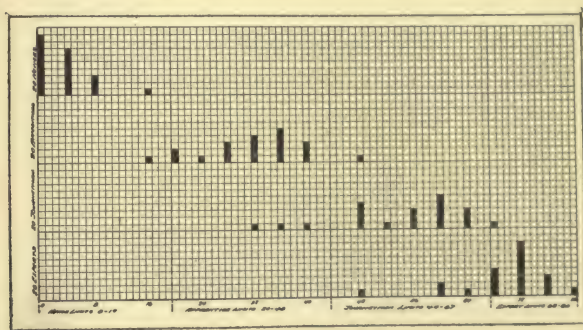


FIG. 2

This chart shows the distribution according to individual total scores of the 80 subjects used in standardization. Each square represents one man. The three vertical dash lines show the limits of the various groups as determined by the distribution of the men used in standardization. The limits shown are the ones finally used in Army testing.

In calibrating, the object is to draw the dividing line between classes so that the overlapping shall be as small as possible.

When these dividing lines, or *critical scores* as they are usually called, are established, the test is ready for distribution to camps.

Picture and Performance Tests.—Picture tests are made in practically the same way as oral tests. The peculiar characteristic of picture tests is that the questions making up the tests relate to illustrations of trade tools and appliances.

The performance tests are now being used in many trades for those who make a satisfactory showing in the oral or picture tests. These performance tests are devised by conference with experts in the trade. They consist of some apparently simple tasks that can be performed quickly and with a small amount of apparatus but that nevertheless indicate clearly the degree of skill of the performer. As a result of experience the following have been drawn up as the requirements for a good performance test:

1. It should require the smallest possible quantity of tools and materials and these should be capable of standardization;
2. A journeyman should not require more than 45 minutes to perform it;
3. It should be typical of the work required;
4. The operations should be exact so that a standard correct form of product is always obtainable.

Performance tests undergo much the same processes of sampling as do the oral and picture tests and they are calibrated in the same way. The principle followed here, as elsewhere, is that the value of a test lies not in its theoretical exactness but in its proved ability to pick out and classify correctly men of all degrees of skill within the trade. If the test does classify men in the groups in which they are known to belong, then it can be relied upon to classify correctly men about whom nothing is known in advance.

DEVELOPMENT BATTALIONS

The previous discussion of personal differences has shown that there is no such thing as a class of perfect men. In the draft there are all degrees of perfection but no two men are alike.

Just how good a man must be physically and mentally in order to be eligible for military service is a question that has received different answers at different periods of this war.

The most common practice is to accept a man for military service unless he has some specific disqualifying defect. The exact degree of defect that excludes him from service is governed by professional estimate of the military chances as laid down by special regulations. As the available man power of a country diminishes the level of acceptable human material tends to sink.

Formerly, unless a recruit could satisfy all the physical requirements he was not accepted for military duty. If a skilled court stenographer had flat feet so that he could not march with troops he

was rejected, even if the army was short of stenographers. The same was true of flat-footed truck drivers and auto repairmen, for which the demand far exceeds the supply.

Recently, however, War Department officials have come to realize the following interrelated facts: first, that even the United States has not such a vast supply of physically fit men that its army can be restricted to such men; secondly, that many duties in the army can be performed just as well by men with certain physical defects. In consequence, a limited service class has been established and is now being drawn from in larger and larger numbers in this country as it is in France and England.

The medical officer in dealing with Limited Service men now recognizes five classes of men as follows:

Class A: fit physically for any general military service.

Class B: (deferred remediable) fit for general military service when cured of a remediable disability.

Class C - 1: (limited service, general); not quite fit physically for general military service, but fit for military service in the Service of Supplies overseas, or general military service in the United States.

Class C - 2: (limited service, special); fit only for restricted military service in the United States in special capacity approved by Medical Officer.

Class D: unfit for any military service.

If men could be definitely placed in the above classes, and then be assigned on that basis plus their previous civilian experience, the personnel officer would have a comparatively simple task. But when we realize that a class C - 1 man may be flat-footed, or slightly deaf, or color-blind, or be lacking in a great variety of minor ways; that in addition he may be a college graduate or an illiterate; may be skilled, partly-skilled or not skilled at all in any one of several hundred occupations; then we come to realize that to place such men in the army is an exceedingly complicated duty. The work becomes still more difficult when it is necessary to assign such men on the basis of requisitions prepared by officers who know what they want but do not know the supply. Moreover, the assigning officer often has no opportunity to see the jobs that he is asked to fill, and must often work from his card records without seeing the recruits. Personnel work thus differs from that of the employment manager in a big business house who personally interviews all applicants.

In order that adequate personal attention be given limited service men, development battalions were created where all such men can be studied and built up when necessary. After careful classification by the surgeon and the personnel officer they may be assigned to appropriate military duties.

Soldiers may be transferred to the Development Battalion from the following sources:

(a) From divisional units, replacement organizations, etc., other than Depot Brigade. These are men who have been accepted as "fit for general military service," but in whom a disability has developed or been discovered since "muster in."

(b) From the Depot Brigade. These are men who have been accepted for general military service but in whose case observation for a period of from one week to one month has shown that a physical weakness exists which may or may not have been noted on the original examination, the nature of the defect making it desirable to transfer the men to a Development Battalion. Probably the majority of these will be men in need of graduated physical training to assure their fitness for general military service. Others will have permanent defects, placing them in the group for "special and limited service."

(c) Registrants, classed by Local Boards as fit for "Special and limited service in a named occupation or capacity," who are sent to camps as result of calls for this class of men, and who need special training or medical attention before they can be used to the best advantage.

It is evident that those with whom the cause of transfer to a Development Battalion is Physical Disability, may be suffering from a variety of pathological conditions. All men as they arrive in Development Battalions will be given special treatment according to their needs.

In each Development Battalion arrangements will be made for giving physical training to such convalescents as may be sent to the battalion for hardening.

When these men have received the necessary hardening, they will be returned to their organizations. Men from Base or other hospitals will not be attached to Development Battalions for physical training unless it is practically certain that they will be able to rejoin their commands within six weeks.

The Development Battalion is a part of the *Camp* Activities and its medical activities are under the general supervision of the Camp Surgeon.

ASSIGNMENT

1. Determine as well as you can where the following men could be utilized in the army, if at all. Be specific in describing the duty they are to perform.

(a) An undersized man who has had six years' experience as a freight agent on the New York Central R. R. at Albany, N. Y.

(b) A wagon freighter across the deserts of Nevada who has a wooden leg.

(c) A college graduate with one year's experience as secretary to a teaming and construction company, but has a weak heart.

(d) A flat-footed railroad engineer.

(e) A very near-sighted (partially corrected by glasses) telegrapher.

(f) An illiterate American farmer with flat feet.

(g) A balloon trapeze performer suffering from tuberculosis.

(h) A pipe-fitter of ten years' experience, minus the first two fingers of his right hand.

(i) An illiterate Russian section-hand who speaks only a few words of English with an intelligence score of B.

(j) The same but with an intelligence score of D.

2. What positions, if any, could be filled by limited service men in an infantry regiment? in an airplane squadron?

THE RATING SCALE

The general laws of individual differences apply to officers as well as to men. Officers differ among themselves in every conceivable way. Their good and bad qualities might be plotted on a distribution curve. The few best at the upper end are proper candidates for promotion. Conversely the few worst at the lower end of the curve may properly be considered for elimination.

One of the most embarrassing and difficult tasks that an officer has to perform is the professional rating of his colleagues. But it is a part of his duty to pick men for special tasks and in a more formal way to select men for promotion and advancement.

To consider all the relevant qualities, to give each its proper weight in estimating the excellence of the composite whole, to free oneself from bias and prejudice, requires more than honesty of purpose. It requires a system of organized judgments. Such a system is the rating scale. As a system its value is greater than the relative estimation of any group of qualities or persons to which

it is applied in any case. With proper modification the system is of universal application. It holds for the selection of non-commissioned officers, for officers material, for promotions, for the selection of students for special training—in short for the selection of men for every task where that selection must be made on the judgment of others.

As applied to officers the rating scale is a practical system by means of which an officer's capacity and fitness for promotion can be gauged quickly, accurately and with uniformity and justice.

The rating itself is a numerical expression of the degree in which an officer possesses the military qualifications deemed most essential: Physical fitness, intelligence, leadership, personal qualities, general value to the service.

The degree to which he meets these qualifications is determined by comparison with officers of the next higher rank. Every officer is measured in terms of the actual ability and performance of other officers.

Where instructions are followed closely the results show a high degree of accuracy and uniformity. The total average ratings of widely separated camps have shown a variation of less than one point in a hundred. The rating scale is a constant and reliable gauge of an officer's merit.

No system has yet been devised which so completely eliminates the personal equation or so justly determines merit. Because the Rating Scale calls attention separately to each of the several essential qualifications for an officer, it lessens the danger that judgments may be based on minor defects, with a corresponding disregard of important virtues.

It takes approximately twenty minutes to create a working scale and sixty seconds to make a rating.

Every officer should be rated by his immediate superiors.

How to Make the Scale.—Make a list of about a dozen officers of your own rank and not above the average age of officers of this rank. They should be men with whom you have served or with whom you are well acquainted. Include officers whose qualifications are poor or mediocre as well as those who are highly efficient. This list serves merely as a convenient reservoir of names; the names actually used in the scale may include others.

Look over your list from the viewpoint of physical qualities only. Disregard every characteristic of each officer except the way in which he impresses his men by his physique, bearing, neat-

ness, voice, energy and endurance. Select that officer who surpasses all the others in this qualification and enter his name on the line marked highest under physical qualities. Now select the one who most conspicuously lacks these qualities and enter his name on the line marked lowest. Select the officer who seems about half way between the two previously selected and who represents about the general average in physical qualities; enter his name on the line marked middle. Select the officer who is half way between the middle and the highest; enter his name on the line marked high. Select the one who ranks half way between middle and lowest; enter his name on the line marked low.

In the same manner make out scales for each of the other four sections (Intelligence, Leadership, Personal Qualities and General Value to the Service).

How to Use the Scale.—Rate your subordinate for physical qualities first. Consider how he impresses his men by his physique, bearing, neatness, voice, energy and endurance. Compare him with each of the five officers in section I of the Rating Scale, and give him the

RATING SCALE

I. PHYSICAL QUALITIES. Physique, bearing, neatness, voice, energy, endurance. Consider how he impresses his command in these respects.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
II. INTELLIGENCE. Accuracy, ease in learning; ability to grasp quickly the point of view of commanding officer, to issue clear and intelligent orders, to estimate a new situation, and to arrive at a sensible decision in a crisis.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
III. LEADERSHIP. Initiative, force, self reliance, decisiveness, tact, ability to inspire men and to command their obedience, loyalty and coöperation.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
IV. PERSONAL QUALITIES. Industry, dependability, loyalty; readiness to shoulder responsibility for his own acts; freedom from conceit and selfishness; readiness and ability to coöperate.	Highest..... 15 High..... 12 Middle..... 9 Low..... 6 Lowest..... 3
V. GENERAL VALUE TO THE SERVICE. Professional knowledge, skill and experience; success as administrator and instructor; ability to get results.	Highest..... 40 High..... 32 Middle..... 24 Low..... 16 Lowest..... 8

number of points following the name of the officer he most nearly equals. If he falls between two officers in the scale give him a number accordingly (*e. g.*, if between Low and Middle give him 7, $7\frac{1}{2}$ or 8).

Rate the subordinate in a corresponding manner for each of the other four essential qualifications. Under III (Leadership) and V (General Value to the Service) consider which officer he will most nearly equal *after equivalent experience*.

The total rating for a subordinate is the sum of the ratings you give him in the five separate qualities. If directions are followed carefully, the average of any considerable group of officers rated is about sixty points. In other words, sixty points for a lieutenant means that a captain has compared him with the captains he knows and certifies that after equivalent experience he will be equal to an average captain.

ASSIGNMENT

In order to understand this system thoroughly the student should make a trial scale and rate the qualifications for officers of five of his fellow students. Arrange your work with one or more students so that several will rate the same men. Compare your ratings to see how closely you agree. It has been found from experience that, on the average, officers differ in their ratings of another officer by not more than five points. At Plattsburg recently the average of several hundred candidates differed by less than two points.

TWO CASES OF LONG LATENT MEMORY

BY HOWARD C. WARREN

Princeton University

It is well known that in old age incidents of early life are frequently recalled which have apparently never been brought up meanwhile. The two following cases are reported merely because they are well-authenticated records, and because there is every reason to believe in each case that the experience was completely dormant during the entire period.

I

The writer's father, D. T. W., at the age of 90 years, 5 months, was conversing one evening recently about the peculiar tricks of his own memory. He mentioned his difficulty in recollecting proper names and recent incidents, whereas he was constantly recalling many trivial events of his boyhood. He related that, lying awake the night before, he suddenly recalled a poem which he had recited at the meeting of a boy's club in Haydenville (Mass.) in 1842-3. Thereupon he repeated the following in a declamatory tone quite unusual to him:

[*Sam Patch's Leap*]

Once more, my Muse, unfold thy radiant wings,
Float thou propitiously o'er me while I sing,
And as I studiously burn the midnight taper,
Guide thou my pen and sanctify my paper.

* * * * *

The throng gathered on the banks of the Genesee
And the thousands stood looking at the torrent below.
Sam was there; he was in spirits, not liquor.
Behold! He makes one glorious leap.

The foregoing copy was not taken at the time, but is a stenographic record of a second repetition a few days later. To the best of my recollection the wording is the same as the earlier rendering. The first four lines are complete and apparently exact with one minor lapse. The rest is fragmentary.

According to his statement my father was about fifteen when he learned and recited the poem. From known circumstances of his

life it certainly could not have been later than his seventeenth year. The interval was therefore seventy-three to seventy-five years. He has been devoted to business pursuits all his life till recently and has never engaged in literary works or made addresses or recitations. He moved from Haydenville soon after and lost touch with his boyhood friends. He had never mentioned either the incident or the club to the family before this. There is therefore no ground for suspecting that the incident was recalled meanwhile. I can find no clue to explain its recall at the present time.

II

The second case, that of J. E. D., father of an intimate friend of the writer, occurred in 1900. The record was made (and dated) on the spot by his son, who reported the incident to me soon after. The suggestion for the recall is an interesting feature of this case.

In 1900, J. E. D. was eighty-three years old and was the oldest living alumnus of Dartmouth College. At this time he received an honorary degree from the institution. He was surprised and pleased at being thus honored. He had been a business man all his life, but had always been literary in his tastes. In the course of conversation about the degree he said to his son: "I wonder if it is because they remember that Freshman oration of mine;" and immediately began to recite as follows:

[*The Athenians*]

In perusing the pages of history, we find the resources of intellect exhausted and the powers of the human mind taxed to the utmost and the most vivid flights of imagination and fancy employed in celebrating the praises and describing the characters of the heroes and inhabitants of ancient Greece; and well may a smile play upon the face of History as she sees the streams of intellect drying up in supplying a pen "plucked from an angel's wing" in describing a people of such character as the Athenians.

Their independence, not subject to the will of Mr. A. or Mr. B., their prodigious, views, their unbounded hopes, their high pretensions, were proofs that they were possessed of a noble and exalted soul. Do we speak of the glorious character of our own country? Compare our borrowed light with that great luminary which has reflected itself over the whole world and affected or almost given birth to the literature and character of every nation enlightened under Heaven.

Athens remains and will forever remain robed in the habiliments of her own glory, an astonishing monument to the eyes of the world.

The oration was delivered at Dartmouth College in the year 1831. The latent period was therefore about sixty-nine years.

Although recited consecutively there are probably certain omissions from the original composition. The speech itself is perhaps of some interest as illustrating the flowery literary style affected in college oratory of that period.

As in the other case there is every reason to believe from the subject's life history that the oration had not been recalled during the intervening period. Indeed, there are several striking points of similarity between the two incidents.

VARIABILITY IN LEARNING

BY L. L. THURSTONE

Carnegie Institute of Technology

It is of some psychological and pedagogical interest to study the distribution of ability of a group of learners at different stages of progress. In this direction we have such questions as the following. Is the distribution of ability for a group of learners symmetrical at all stages of progress? If not, in what direction does it become skewed with practice? At what rate does the change in skewness take place with reference to the units of practice? What is the nature of the relation between practice and the standard deviation of attainment at successive stages of practice? We should be able to express a student's standing at any stage of practice in terms of the standard deviation of the group at that particular stage.

With such questions in mind I have analyzed the learning data for a group of 165 drafted men in Pittsburgh who have been studying telegraphy at the Carnegie Institute of Technology. These students took a receiving test in telegraphy at every meeting of their classes. I had planned to continue filing these records until the physiological limit of each student was in sight, but most of the men suddenly enlisted as radio mechanics in the army and consequently these records can not be carried toward their physiological limits. However, the records so far accumulated cover the first one hundred hours of practice and I shall present them.

In Fig. 1 we have the relation between practice, expressed in terms of hours, and median receiving speed in telegraphy for the group, expressed in terms of words per minute. It is apparent that the relation is linear within the limits of observation, from the twentieth hour of practice to the seventy-second hour of practice. So far our procedure contains nothing new. It is simply a pooled learning curve representing the median progress of the group. The upper curve in Fig. 1 shows the upper quartile receiving speed, plotted against hours of practice. The lower curve shows the corresponding lower quartile receiving speed. These two curves are also linear within the range of observation. The vertical distance

between the median curve and the upper curve at any point is the upper semi-interquartile range of receiving speed at that stage of practice. Similarly for the lower semi-interquartile range.

Two interesting facts appear in this diagram. The variability of the group, here expressed as the quartile range, increases with

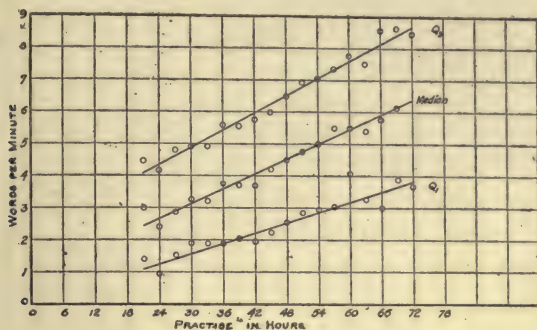


FIG. 1.

practice. This is perhaps to be expected anyway by common sense for if a frequency surface of attainment be plotted at each successive stage of practice, the range should increase with practice while the frequencies should decrease to keep the areas of the curves constant. Hence any measure of variability must increase with practice. Learners separate from each other more and more in attainment as they progress.

The second fact which appears in Fig. 1 is that the two semi-interquartile ranges at any stage of practice are comparable in magnitude. This would not necessarily be so from *a priori* reasoning. This indicates that the frequency surface of attainment is practically symmetrical throughout the range of practice covered by our observations. It does not necessarily follow that the surfaces are normal.

Since the standard deviation is a more acceptable measure of variability than the quartile ranges I have tabulated it for every test of receiving speed. One such test was given at every three-hour meeting of the class. Fig. 2 shows this relation between practice, expressed in terms of hours, and the standard deviation of attainment, expressed in terms of words received per minute. The variability evidently increases with practice. The curve is linear within the range of observations but obviously it can not be expected to continue so because that would lead to infinite variability with continued practice which would be absurd.

MEMORY

BY WARNER BROWN

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All the theories concerning retention in memory between the time of impression and the time of recall are reduced by Larguier des Bancelles (8) to the two advanced by Plato: either there is a *trace* remaining, notion of the wax tablet; or the image *survives*, notion of the captive bird. The choice between these views depends upon metaphysical, not psychological, considerations. Baillie (2) claims objectivity for the objects of memory-knowledge and concludes that no theory of knowledge can be adequate which takes its start primarily or solely from our sensorial knowledge of the outside world. For Laird (7) memory has become the meeting point of two dissimilar lines of research, to the reciprocal benefit of the philosophy and psychology of today. This is said by one who thinks that the psychological investigations into memory have received a powerful impetus from the pen of Bergson.

The much discussed experiments of Ebert and Meumann on the transfer of training in memory have been repeated by Reed (13). The practice group consisted of eight subjects. They received an amount of practice on nonsense syllables at least as great as that given by Meumann. The control group consisted of six (later five) persons. Seven tests of memory-span and six tests of learning were performed by both practice and control groups before the practice work and after its conclusion. There were some deviations from the technique of Ebert and Meumann, particularly with regard to the amount of work in practice per sitting and the alternation of the methods of learning. In addition to the methods of scoring employed by Ebert and Meumann several others are used by Reed. When the various methods of scoring are considered, and the amounts of the average deviations, it appears that the small apparent advantage of the trained over the untrained group in the second test is not significant. The data show in the tests of learning ability, as well as in the tests of memory-span, that training in learning nonsense syllables does not give, in dependable amounts, increased ability to learn or to remember other kinds of material.

The experimenter makes the suggestion that results reported by Ebert and Meumann may be due to revival of the practice in memorization which their subjects received during their school days. The paper contains contributions to the questions of whole versus part methods of learning and of the effect of the length of series upon the amount and parts recalled.

An individual study is reported by Aschieri (1) of a normal child of eight years and a subnormal child of sixteen, both of the mental age of ten and equally advanced in school. Memory-span, speed of learning, and quality of reproduction are considered. The most valuable conclusion is that subnormal cases as well as normal possess distinctly individual characteristics and never conform strictly to type. Deaf children in the Ohio State School for the Deaf were found by Pintner and Patterson (12) to be much inferior to normal children in visual memory for digits. Their inferiority in this respect was greater than their performance in other tests would lead one to expect. The visual memory of the congenitally deaf was not as good as that of those children who had had some auditory experience. The investigators are led to conclude that auditory experience and probably auditory images play an important part in the recall of digits presented visually. A predilection on the part of women for memory work is shown by Gates (3). In a long series of examination questions where an option was given between a question involving reasoning and one depending solely on memory women chose the memory questions more frequently and were relatively more successful in answering them than men. Those women who did choose the reasoning questions were relatively unsuccessful in answering them. Other tests given independently to the same subjects showed the women to be superior to the men in immediate memory and in retention. Tests for recall and recognition of words, geometrical figures and nonsense syllables were applied to 638 children in the fourth to eighth grades by Mulhall (10). She found that both forms of memory improve with age and with school grade, but that the younger children in a grade are somewhat better than the older ones. Girls do better than boys with words and syllables but not with geometrical forms.

Seeking a practical test for the ability to associate peoples' names with their persons Gould (6) allowed his subjects to study the names attached to twenty photographs for five minutes. A high correlation results between the ability to recall these names when the pictures are presented alone and the ability to recall the

names of seventeen strangers who were introduced to the same subjects. According to an experiment by Gordon (5) a musical selection is easier for musical subjects to learn than a series of nonsense syllables constructed by making one syllable correspond to each note and presented in the same tempo. But non-musical subjects find the syllables easier to learn. The music was not presented in vocal tones in the manner of the syllables, but was played over on the piano, then sung by the learner, then played again, etc. That the arrangement of the music facilitates the learning process is shown by the increased difficulty of learning the notes presented in reverse order. Myers (11) finds that normal school girls one year after completing a high school course in history are able to associate some fact correctly with forty-five per cent. of a list of names of persons notable in American history. The order of success in the memory test corresponds fairly well with the frequency with which the names are mentioned in text books in the case of military names but not in the case of civilians. This study is one of a series intended to measure the progressive loss in memory for the same individuals over a period of several years.

Morgan (9) finds by introducing noise into the work room that the formation and retention of connections between syllables and numbers is interfered with to a degree which is not compensated for by the greater effort put forth under such adverse conditions. Recitation as a factor in memorizing is analyzed in a monograph by Gates (4). Experiments were made with children from the first to the eighth grades (about forty in each grade), and with fifteen adults, in memorizing nonsense syllables and sensible material consisting of brief biographical statements. The amount to be studied always exceeded what could be learned in the time allotted. The effects of practice, time of day, inequality in test material, individual differences and other possible disturbing factors were controlled by dividing each group of subjects up into squads among whom the successive tests were assigned in such sequence as to equalize all of these factors. The material was studied either by continuously reading over and over or by a certain amount of reading followed by attempted silent recitation with correction by reference to the copy in hand. The amount of time devoted to reading ranged from 100 per cent. down to 20 per cent. by steps of 20 per cent.; and in the case of sensible material down to 10 per cent. The results show a marked advantage for recitation, increasing steadily as the proportion of time devoted to reading is reduced,

until not more than one fifth or two fifths of the time is devoted to reading. The advantage of recitation is greater for recall delayed three or four hours than for immediate recall, and greater for nonsense than for sense. Analysis shows an advantage for recitation arising from articulation, accent and rhythm, localization, the noting of meaning and relations with unusual characteristics of the material, grouping, confidence from testing, increased satisfaction from knowledge of success and absence of monotony. Memorizing with recitation is shown to conform much more closely to the normal process of sensory-motor learning than does memorizing by a series of visual impressions.

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THE
PSYCHOLOGICAL BULLETIN

THE OBTAINING OF INFORMATION: PSYCHOLOGY
OF OBSERVATION AND REPORT¹

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1. *Information is a Normal Precedent to Action.*—If we could imagine an animal without any senses, it would be hard to imagine what would ever induce this animal to do anything at all. It would never see anything nor hear anything nor smell anything nor taste anything nor feel anything that would make it want to move, either to secure food or to avoid an enemy. On the contrary, really our behavior is virtually under constant regulation and direction from our senses; we move toward what attracts us; we run from or attack what we fear or dislike. The more complete this guide from the senses, the more information we have, the more successful we may expect to be. For the most sagacious action we need to possess as complete knowledge as is feasible concerning the conditions that surround us.

2. *The more complex the action possible, the more complex the prerequisite sensory machinery.* The jelly fish and the oyster can do but little after all; they need, then, but little information from their sense organs. What advantage would accrue to the oyster even if he could have a pair of ears grafted upon him? But we human beings possess a most elaborate set of muscles; we can move our bodies in hundreds of ways that the jelly fish and oyster cannot. To get the best efficiency from this elaborate machinery for moving, evidently we need a correspondingly elaborate machinery for sensing. And we do, indeed, find that the machinery possessed by human

¹ Outlines of the Study of Human Action for the Students Army Training Corps, Section VI.

beings for getting information about what is happening in the world about our bodies (the various sense organs), and especially the machinery for storing up this information (the cells of the brain itself), is far and away superior to that possessed by other and less complexly constructed animals. The same thing is true also of the machinery for making records of this information and for transmitting it to others (gesture, handwriting, speech, reading, etc.).

3. *The analogy holds true by extension with groups of men, like an army, organized for a common purpose.* When a group of human beings gets together and acts more or less as a group many of the principles that apply to the behavior of one person alone apply also to the group. An army is a group of this sort. It is no mere fanciful term to say that an army is an organism; it is a living thing, organized for a definite purpose, having definite ways of behaving and (what we are now interested in) having definite need of information to guide its movements.

In addition, therefore, to motor transports, supply services, quartermaster and ordnance departments, infantry, cavalry, machine gun battalions and all of the other elements in this huge organism, there must be some sort of mechanism for "sensing," for getting information that will guide the activities of the whole affair just as your steps along a rough path in the dimly lighted forest are guided at every instant by the help given through your eyes, through your ears, through the "feel" of the ground to your feet, and even perhaps through your nose. This sensory mechanism in the army is illustrated in its intelligence sections, its scout service, its balloon and aeroplane observers, its spies, its quizzings of prisoners of war, its reports from officers, its signalling systems, and the many other methods by which information concerning both its own doings and those of the enemy is gathered, sifted and fitted together, finally to emerge in the guise of complicated orders for the movement of troops, guns and supplies. This information guides the activities of the whole military organization.

4. *Modern military conditions demand the utmost in complexity and efficiency of the intelligence service.* Every one knows that the great World War in which we are now engaged exceeds all previous wars in magnitude of operations, in elaboration of detail and in complexity of the agencies made use of. Every device known to

modern science has been seized upon and thousands of workers are laboring to invent and perfect new ones. Our analogy holds here, too. Just as the individual man with his complex motor mechanism is equipped with a sensory mechanism much more effective than that of animals with a simpler sphere of movement, so our armies in this extraordinary combat need the most effective intelligence service that our brains can devise. We need cite merely the use of the aeroplane and the wireless as illustrations of the utilization of the most recent inventions for increasing the effective range of vision and speeding up the transmission of information. Just suppose that some inventive genius had been able in the Civil War to equip one side with a squadron of airplanes and a wireless signalling system, can we doubt that the tremendous advantage that would have resulted in the gathering and forwarding of information would have speedily brought victory in its train? No wonder that the airplanes are termed the "eyes of the artillery" and that the gaining of supremacy in the air (which means, of course, not only getting information freely of the enemy's movements but also preventing them from getting information of our own movements) is a most powerful aid to victory.

5. *Inefficiency in the intelligence service is correspondingly serious under modern military conditions.* If we human beings gain much by our finer nervous organization we also pay the penalty of being more liable to damage and more hampered by the damage if it occurs. We know how true this is of all sorts of machines. To drop a high-grade watch is more costly than to drop a dollar alarm clock. Pneumatic tires permit faster speed and more comfort than solid tires, but they are liable to puncture and when punctured are less efficient than a solid tire. The very bigness and complexity of modern military organization increases tremendously the need for watchful care over its parts. If the intelligence service breaks down, the army is like a man with his senses clouded by some stupefying drug. What perhaps is worse, if errors are reported as truth and accepted as truth, then the army is like a man who is being unwittingly misled by an illusion. It is often worse to think you know when you don't than it is to be ignorant and know you are ignorant. In fact, not to know you don't know is often the acme of foolishness.

6. *Despite all the refinements of mechanism that science has invented the collecting and interpreting of information must remain a human*

activity. Field glasses, to be sure, bring distant guns near the eye; periscopes permit the trench fighter to watch his enemy without exposing his head; the modern camera reveals a mass of details that would escape the best observer; and microphones when properly constructed and adjusted reveal the faint throbs of a distant propeller. Nevertheless, it is always some human being that looks through the glass of the periscope, that unravels the meaning of the photograph, or that listens to the microphone. It is always some human being that seeks to understand the meaning of what is seen and heard, some human being that writes down this meaning or speaks it or signals it by gesture or wigwagging or heliograph; it is some other human being that reads what has been written or hears what has been said or receives the signalled message.

And we are told, and it is true, that "to err is human." In every link of this chain of processes necessary in gathering and reporting information there lurks the possibility of inaccuracy. It is the business of the psychologist, who studies human nature, to point out to you where these mistakes are likely to occur and to help you to avoid them, just as it is the business of the physicist and the chemist, who study the properties of substances and the ways of combining them into various instruments and processes, to tell you how to use these aids in gathering information with the lowest possible margin of inaccuracy. This section aims to show where human beings most often go wrong in the use of their senses and especially in bringing in such reports as are required by the intelligence service of our army in the field.

7. *The first condition for getting accurate information is the possession of reasonably efficient sense organs.* It is true that information has to be "digested" to be of value; that all observation has to be guided from within by an intelligent brain; a baby does not "observe" in the sense of making systematic and planful scrutiny of objects and events about him; he doesn't yet know what to look for. But on the other hand, an intelligent adult has to get his original stock of material through his sense organs. Our ideas about colors, odors, sounds, the way things feel and taste are all ideas that are based on experiences obtained through our senses. We know of no colors we have not seen, of no odors we have not smelled. The man born blind cannot even imagine the blue of the sky. We do not mean that only persons with the most exceptional equipment of sense organs can be made into competent observers,

because so much does depend on knowing what to look for, what to listen to. But we can say that, other things being equal, the possession of sharp senses is a decided asset for the obtaining of precise information. The more difficult the conditions under which the information is to be gathered, the more important it is to use observers with superior sensory acuity. Attention has been called in Section II to the wide range of individual differences in all forms of mental equipment. We need to note in the next few pages how some of these individual differences in sensory capacity may affect the usefulness of men chosen for observation work.

8. *Men differ in their capacity to see colors.* About four men in a hundred are color blind. Certain reds and greens, especially tints and tones of these colors, when combined with other colors, like reddish browns, bluish or yellowish greens, or bits of red and green when seen briefly or dimly are not seen as normal persons see them, and consequently reds and greens are often confused under these conditions. Since this kind of visual defect is inborn and incurable, it is important that the color-blind man be not placed in positions, as in naval look-out work or in railway service, in which the confusing of red and green signals might lead to disaster. Tests to ascertain the presence of defective color vision are quickly and readily made.

9. *Men whose color vision is perfectly normal differ much from one another in visual acuity, that is, in the sharpness of vision.* A famous physicist is said to have remarked that if his instrument maker brought him an optical device as poorly made as the human eye, he would discharge him on the spot. It is true that the eyes of all persons are subject to various deficiencies when compared with instruments of precision. It is likewise true that, even when these defects common to all eyes are disregarded, even then flawless vision is extremely uncommon. Nearly every person has a slight defect of shortsightedness or farsightedness or of astigmatism. The ordinary letter tests of the oculist and optician are designed to reveal the presence of still more obvious degrees of these defects. A slight degree of farsightedness may produce no reduction in the keenness of vision, but merely render its possessor liable to eye-ache or headache. Wearing glasses will usually eliminate this sort of disturbance. A moderate degree of shortsightedness, however, is not likely to produce eye-strain or headaches, but does cut down

the clearness of all objects located more than a few feet away from the eyes. Here again, properly fitted glasses will usually restore vision to normal or nearly normal efficiency. Men who need to wear glasses to get comfort or clear vision may, accordingly, see just as well with their aid as other men whose eyes are pronounced "perfect," but it is obvious that men with glasses make poor risks for some branches of the military service in that their power to see clearly would be lost if their glasses should be lost or broken.

It is also true that men differ measurably in the sensitivity of their vision, quite apart from these differences that have just been mentioned. For special work it might be distinctly worth while to select men possessed of the highest degree of sensitivity of the retina.

10. *Again, men without defects of color vision or of visual acuity and who are equally good at seeing in the daytime may be quite unequally good at seeing in the nighttime.* This is because the retina of the eye (which corresponds to the sensitive film of the camera) is really made up of two distinct sets of sensitive substances—the one especially designed for the high illuminations of ordinary daylight seeing, the other especially designed for the low illuminations of twilight and dark seeing. There are some men whose night eye is so poor as to be almost useless; there are others whose night vision is exceptionally good. It is obvious that in a group of men selected for night patrolling there ought to be no men of very poor night vision and at least some men of extra good night vision. Naturally, as has already been noted, it does not always follow that the man with the keenest vision is the very best observer; men with only average eyes may be trained to make reliable first-class observers.

11. *To get the best results with the night eye it is necessary that the retina of any observer should have a certain amount of time to get used to the dim illumination.* Every one knows that in coming out of a brightly lighted room the night seems pitch black, but that little by little our eyes get used, or "adapted," to the darkness and that objects previously invisible begin to emerge. But not every one knows that this process of "dark adaptation" goes on for as long as an hour and that there is especial improvement between the 10th and the 30th minute. It follows from this that for the best results, visual observation at night ought to be undertaken after the eyes

have been kept from all bright light for half an hour or more. Night patrol workers ought not to look at flares, rockets and other bright illuminations if they wish to have their eyes in good shape for seeing dimly lighted objects for several minutes thereafter. It would probably pay to use only one eye if bright objects had to be looked at, so that the other might have its dark adaptation preserved.

12. *The twilight eye sees better out of its "corner" than straight ahead.* In ordinary seeing we always turn our eyes to look directly at the object that we are observing, but experiments show that at night the eye is very much more sensitive to faintly visible objects that are seen at one side of the direct line of regard, namely, that are seen in what the psychologist calls "indirect vision." It would be quite possible, then for some object to be "seen" by the "tail of the eye" which could not be seen when the gaze was turned directly upon it. Men destined for night patrol work might profitably be trained to give attention to things seen in indirect vision.

13. *The twilight eye sees no colors.* The French have a saying: "la nuit tous les chats sont gris,"—"all cats are gray at night." This saying calls attention to one further peculiarity of night vision; unless the source of light is strong enough to excite the daylight eye, all objects appear colorless in night vision, for the twilight eye has no mechanism for responding to light waves of different lengths with the series of color sensations of ordinary vision.

14. *Men differ from one another in their acuity of hearing and the acuity of the same man differs at different times.* The testing of hearing cannot be carried on as conveniently nor as precisely as the testing of vision, nor have we any well defined standards of what constitutes normal hearing. Nevertheless, it is possible by tests in which numbers are whispered at given distances from a group of men to pick out those whose hearing is peculiarly good or peculiarly poor. These tests will often demonstrate that some men do most of their hearing with one ear, just as some men do most of their seeing with one eye and never discover it until they happen to be tested. It is worth remembering, too, that the sensitivity of the ear is almost always reduced when there is inflammation present in the nose and throat. For this reason men who are suffering from a nose cold or a sore throat ought not to be assigned to duties

demanding the listening for, and locating of faint sounds, as, for instance, in using the hydrophone.

Here, again, as in the case of the eye, training is important. To be a "good listener" for military purposes means more than being able to detect very faint sounds; it means also understanding what they may mean, from what direction they come; it means also the ability to disregard the multitude of faint sounds, like the little noises attendant on breathing, and the "pumping" of the blood in the ears, that are unimportant and that are literally not heard under ordinary conditions.

15. *Similar individual differences exist in the sensitivity of the other sense organs.* It is seldom, perhaps, that military activities demand men with specially sensitive noses or tongues or fingers, but it will be understood that in these senses, too, men differ from one another in their natural capacity. Every one has heard of the work of professional tea tasters and wine tasters and we occasionally find men whose sense of smell is well nigh superhuman, who, for instance, can identify metals or the coats of their acquaintances by smell alone. As for the fingers, we know that workers in factories that demand sorting articles by touch differ decidedly in their delicacy and speed of work. In teaching men who have become blinded to read with their fingers the raised print for the blind we encounter similar individual differences; some learn rapidly, some slowly and this quite apart from general mental ability or previous ability to read with the eyes. Again, there exist differences in the sensitivity of what are called the "semicircular canals"—structures closely associated with the internal ear but sensitive to changes in bodily position instead of to sound waves. When these canals are stimulated, they produce the sensation of giddiness or dizziness. It was supposed in the earlier months of the war that successful aviators must be men who did not readily experience this sensation and on that assumption many men were rejected from the aviation service after tests with revolving chairs, turntables and similar devices for producing giddiness. The more careful experimental studies of psychologists both in America and England have shown that success or failure in aviation is not closely associated with the absence or presence of sensations of dizziness.

16. *Under everyday conditions sensory acuity may often be measurably lowered without appreciably impairing a man's general efficiency.*

One reason why men whose sense organs are not 100 per cent. efficient may get along so well that they never suspect their deficiency is that the requirements of daily life are not so rigorous as those set up by the stringent necessities of military activity. Another reason is that a defect in one sense organ is often overcome by the, at times unsuspected, assistance of the other sense organs. A person slightly hard of hearing forms the habit of watching the mouth of the person to whom he is listening, and he also mentally fills in many gaps in the sentence that he didn't fully hear. When you listen to some one who speaks in a foreign tongue, as, for instance, when you try your French in France, you discover how necessary it is to hear every sound, because you cannot then fill in easily from your general knowledge of the language. As for the blind, they learn to use their fingers, feet and ears and perhaps their noses so well in getting about that it has been seriously contended that some of the blind develop a mysterious "sixth sense" that affords them information to guide their steps. And then again, training, while it cannot make any actual changes in the efficiency of the defective sense organ itself, may teach the man to use very skillfully what capacity he does have. We have long been amazed at the extraordinary powers of observation of scouts and hunters of savage and primitive races who guide white men unerringly over ground where no sign of a trail seems to exist or who detect the presence of game or of enemies at distances that seem impossible. Yet Dr. Rivers, an English psychologist, who was able to measure accurately the vision of natives of the Torres Straits and of Patagonia, found their actual sensory capacity no better than that of normal civilized whites. Long experience had developed a special kind of skill in interpreting what was pictured on the retina. These very natives would have found it difficult to find their way about London or to distinguish a flivver from a Packard a half mile away.

17. *In using the sense organs there appear certain illusions, common to all persons, and these, if not understood may lead to false interpretations of what is being observed.* On a sheet of paper draw a line about three inches long. At each end put an arrow head with the barbs about a quarter inch long and both facing inward. About an inch below draw another line just the same length but with arrow heads both facing outward. You will find that, even though you know the lines are equal and deliberately try to disregard the "pulls" of the arrowheads, nevertheless the lines persist in

seeming unequal in length. This is one of the stock samples of "optical illusions," more of which can be found in almost any textbook of psychology or physiology.

There are many illusions of length and distance; there are others that make us see objects out of perspective; there are others that give us wrong notions about the motion of objects. Who has not thought his own train in motion when really it was the train on the next track that was moving by in the opposite direction? A recent writer contends that good swimmers have been drowned by giving up in despair because they thought themselves being swept out to sea by an offshore current when in reality they were affected by an illusion produced by the breaking wave crests sweeping by them towards shore.

18. *In judging the direction from which a sound is coming there are certain illusions that often introduce error into this sort of observation work.* Sit down and close your eyes. Let some one move about noiselessly and snap his fingers or emit a very brief whistle. Try to point toward the source of sound or to describe its direction, *e. g.*, directly ahead, obliquely to the right and above, etc. Notice that sounds coming from any point in the median plane (equidistant from the two ears) are especially hard to locate, whereas right and left are seldom confused. When uncertain as to whether a given sound is in front of you or back of you, let it be repeated while you turn your head and try again to locate it. Try the same thing with the use of a whispered two-place number instead of the snapping of the fingers. Again, let the experimenter stand about two meters distant and snap the fingers of one hand, then of the other in close succession; notice how far apart his hands must be to enable you to distinguish the different directions of the sounds when the experimenter is standing at different places. These experiments may be varied by having the listener cover one ear completely with the palm of his hand. The general principle brought out is that the direction of a sound is judged largely by the differences in its intensity in the two ears, and in wave phase, so that when the source is nearly equidistant, serious illusions may enter into the observations. The application of this principle to scout and patrol work is evident enough.

Another source of error in locating sounds arises from a strong tendency to associate sound with movement. If tests like those suggested just now can be arranged outdoors at night with the

listener's eyes open and several persons, so placed as to be barely visible, coöperate as experimenters, this last-mentioned source of illusion can usually be demonstrated easily. Thus, if *A* moves his hand perceptibly just as *B*, who remains invisible, snaps a twig, the listener is very likely to connect the noise he hears with the movement he sees.

19. *Under some conditions an observer may believe that he has perceived an object when in reality he is the victim of an hallucination.* In the illusions just discussed the observer states that he perceives a certain thing, but we know that a certain amount of error has crept into his statement. His sense organs have been stimulated, but his interpretation of this stimulation is more or less wrong. It will be understood that whenever we perceive anything at all we must to some extent be interpreting what our sense organs actually give us. Suppose a baby and a man both watching a battle; to the baby there would be a confused, meaningless jumble of sounds and sights; to the man these same sounds and sights would have immediate meaning—in short, he would understand what he saw and heard. He could do this because of his experience. The brain contributes to our seeing quite as much as does the eye. If, then, we ordinarily “read into” our sensations much that is not actually there, it will be intelligible how occasionally we might contribute too much or quite distinctly erroneous interpretations. When this occurs, as, for instance, when a man who is wide awake thinks he sees a ghost or has some other supernatural apparition, we call the experience an *hallucination*. An hallucination, then, is a false perception of an object or event when there was no such object or event to be perceived.

20. *Hallucinations may affect any man and are especially liable to occur under abnormal nervous conditions, like extreme fatigue, drugging or emotional excitement.* It used to be thought that a person who had experienced an hallucination was both a rarity and an oddity, but the inquiries of several investigators show that at least one person in every ten will at once admit having mistaken imagination for reality at some time in his life and that most other persons make the same admission after they have had the question explained to them.

When we seek for the conditions under which hallucinations are most liable to occur, we encounter a number of them that are

quite characteristic of military situations. Fatigue, for instance, is a condition that favors hallucinatory experiences; in fact, one of the commonest simple hallucinations is to imagine you hear your name called by some one just as you are falling asleep. In this hallucination, the voice is curiously clear and distinct and seems to come almost from your very ear. Men worn out by battle, whose nerves are either taut with momentary excitement or unstrung in periods of respite, are in a condition that favors the false perception of things that are not present. Various anecdotes from the Front narrate the seeing of visions and apparitions of this hallucinatory sort: Joan of Arc is said to have reappeared to the French soldiery; Christ upon the Cross was clearly seen hovering over the battle field, and so on.

21. *Observation is peculiarly influenced by expectation, so that errors amounting to distinct illusions or hallucinations may arise from this source even when fatigue and emotional excitement is lacking.* We tend to see and hear what we expect to see and hear. Some one in a crowded waiting room is pretty sure to think he hears the whistle of the train that is an hour late and to precipitate a vain stampede to the platform. If you have ever read accounts of the way the professional conjurer "pulls off" the tricks that have mystified you, you surely have been amazed at the simplicity of most of them and of the prominent rôle played by attention. It is part of the conjurer's stock in trade to make you look toward one end of the stage when something important is going on at the other end. Thus, in the familiar scene in which a gold ring borrowed from the audience is being apparently smashed to bits, packed in a pistol and fired at a pile of boxes, only to be recovered later intact and adorned with blue baby ribbon in the inmost box—in this scene the business of pounding up the ring is carried on in the center of the stage at the front and with sufficient flourish to keep the eyes of the audience from the hand of the assistant as it deliberately picks up the real ring from a table at one side of the stage and subsequently sets out the group of boxes properly arranged with the ring inside them.

22. *If the expectant attention is properly directed, however, the efficiency of observation is very greatly increased.* It is hardly possible to exaggerate the rôle played by expectant attention in observation. It is clear, too, is it not, that this rôle may be highly favorable or

highly unfavorable, according as the expectancy is right or wrong. If a sniper is hidden at a certain point and I know that he is somewhere near there and that he is probably camouflaged by a certain kind of coat and hat and that he will fire his rifle if I display something to attract his shot, then I have a better chance to detect his location than another observer who is not prepared by this knowledge of about where to look, when to look and what to look for. Most of the training in observation consists in coaching men in this sort of preparation, in teaching them what to listen for and what to look for—in other words what to attend to. To grasp quickly what things should be attended to is a matter of general mental ability, of general intelligence, not a matter of sharpness of the senses. This is one reason why, as has been noted already, men with superior intelligence and only average eyesight or hearing may make excellent observers. In selecting men for training in the work of intelligence sections the possession of this capacity to grasp explanations quickly is therefore of considerable importance. Presumably men who attain *A* or *B* ratings in the army intelligence tests ought to be much preferred for work in these sections.

Another way, perhaps, of stating the principle of this paragraph is to point out how all of us notice the things in which we are interested and tend actually not to perceive the things in which we are not interested, because to be interested in a thing means that we attend to it readily, naturally and with satisfaction. The experienced aviator hears a disturbing note in the hum of his motor that would pass unnoted as well as unrecognized by the novice, but he might well be found at loss if asked to say whether or not an oboe was being used in the military band that was marching by, this not because he could not be trained to “hear out” the strains of the oboe (his keenness of ear is attested by his hearing of his motor), but because he had no natural interest in that instrument. Notice what events and objects you find yourself “full of” just now that never caught your attention before. You will discover that the moment you get interested in something, you begin to notice it about you as you never did before. You will also discover that the more you know of this thing, the better you can observe it. Generally speaking, persons who are acknowledged to be “good observers” are found to be persons who have a considerable curiosity about the details of things they see and hear and also a good stock of general information about them. They have a habit of observing things. The more they observe, the more they know; and the more they know, the more intelligently they observe.

23. *Even under the most favorable conditions there is a distinct limit to the number of things that can be attended to at once.* Draw on a good-sized piece of cardboard or on the blackboard a rectangle, say 30 cm. square, and in it make about a dozen figures of different sorts, as an arrow, circle, a triangle, an ellipse, an acute angle, a letter T, a figure 8, etc. Keep this concealed from a group of observers until they are warned to give close attention and be ready to draw or describe all they have seen. Have it understood that the drawing will be seen just 5 seconds. Note the number of drawings correctly reproduced by members of the group of observers.

Assemble on a table 12 small and familiar objects, such as a ruler, a match box, a pen, a knife, a penny, a key, a postage stamp, a cigar, a bit of cloth, a piece of chalk, a pebble and a leaf. Cover these with a cloth; let observers stand about the table, four or five at a time; explain the test; remove the cloth just for 5 seconds then let them about face and write down the names of as many articles as they can recall.

Put on the blackboard or on a sheet of cardboard a column of 10 nonsense syllables, like these: *tob, arg, ime, arl, elt, vid, ool, bli, ild, vel*. Keep them concealed until ready for the test. Explain that you will read a paragraph on the subject of coincidences and that when the reading begins, there will be displayed a column of 10 three-letter nonsense syllables, like *ept* or *aum* (write these samples). The observers are to do their very best and try seriously to remember as many as possible of the nonsense syllables. Nothing is to be written during the reading. Warn against giving way to laughter during the trial. Read the following paragraph distinctly and not hurriedly:

"Coincidences in names are of such frequent occurrence as to be familiar; but some of them are surprising. Daniel Webster married Catherine Le Roy. Not very long ago in Boston a suit was noticed, the parties to which were Daniel Webster and Catherine Le Roy. The First Unitarian Church of the city of Baltimore was attended for more than forty years by a gentleman recently deceased. From that pulpit he heard discourses by Doctors Furness, Bellows, Sparks, Burnap, and Greenwood. Two were settled pastors; the others, eminent men who appeared on various occasions. In Guilford, Conn., till within a few years, the Second Congregational Church had had but three pastors in its entire history—Root, Wood, and Chipman. This society resulted from

a disturbance in the First Church, and when Mr. Root was about to be installed, one of the members of the First Church, with equal bitterness and wit, suggested a text, 'And I saw the wicked taking root.' Not many years since the city of New York had attention drawn to the names of four great criminals whose names contradicted their characters—Charles Peace, who had personated a clergyman, was hung for murder in England; Angel was the name of a defaulting cashier; John Hope, of one of the robbers of the Manhattan Bank; and the Rev. John Love was deposed for crime. On the day that the Hon. John P. Hale died, the schooner John P. Hale ran ashore on a reef called Norman's Woe."

From these three experiments the following results will emerge:² (1) Unless the various objects can be recalled by scheme of grouping (as associating pen, pencil, chalk and postage stamp with the idea of writing), the average number of impressions grasped in the first two tests will be four to seven. (2) Many observers will notice that just at the moment the exposure of the forms or objects ended, they felt that they had grasped more than they can recall when they seek directly afterward to write them down. (3) Many observers will notice that they recall even things seen much better by thinking of the names of these things than by trying to remember how they looked. (4) Observers who have high scores will almost invariably be found to have hit upon some clever scheme of combining the objects into groups. (5) In the table test individuals will range from as few as 3 to as many as 10 objects, averaging about 6. (6) In the third test there will be much difficulty and confusion; attention will never be given keenly to both the reading and the nonsense syllables at any one moment, but rather there will be an alternation of attention, now to the one, now to the other, or else the observer will give up entirely the attempt to distribute or to alternate his attention and will be able to report only on the syllables or on the paragraph. This general result will hold true under various analogous conditions, *i. e.*, it is practically impossible to give really keen attention at any instant to more than one thing if the things are of different kinds and especially if one of these things is something to be looked at and the other something to be heard. If you will think of situations where this rule seems not to hold, you will discover that they are situations in which one of the

² The experimenter will find further suggestions and much additional discussion of these tests of attention in the writer's *Manual of Mental and Physical Tests*, Baltimore, 1914, Vol. I, Tests 24, 25 and 30.

things can be done more or less automatically, without demanding real attention. You can lace your shoes and listen to the talk of the men about you, but the shoe lacing is not requiring careful attention, or if it should need it for a moment, just then you would lose the thread of conversation.

24. *The degree of attention that can be given is not constant, but varies from moment to moment. Especially for difficult observation, the best attention can be secured only after a preliminary warning.* It has already been shown what an important factor in good observation is found in preparedness, in knowing *what* to look for. It may be added here that it is equally important to know *when* to look, *when* to listen. Experiments in the laboratory bring out very clearly, what after all we know from everyday experience, that even when an observer is supposed to be watching, to be continuously attentive, yet he succeeds better if he gets a warning signal—a “now”—some one or two seconds before he is required to exert his best efforts. The degree of attention that is present appears to fluctuate, to wax and wane. The best observation work is done when the attention wave is at its crest.

25. *The attempt to give continuous attention for a considerable time, especially to watch for objects or events that are hard to observe or whose precise time of appearance is unknown, exacts much effort and tends to develop correspondingly rapid fatigue.* The truth of this assertion is readily demonstrated by simple experiments, as for example, blindfolding several observers and seeking to find out which one first hears the ticking of a watch which will be just barely audible at any moment within the next 20 minutes. Another illustration is to be found in the decided fatigue that ensues upon an attempt to follow for an hour a conversation carried on in a foreign language of which the hearer knows just enough to keep the general thread only if he listens carefully to every word. Or, again, in the decided fatigue that ensues upon a day spent in sight, seeing in some novel surroundings where everything catches one's attention, *e. g.*, the first day spent in a foreign country or at a World's Fair. Men ought not to be expected, then, to carry out difficult, continuous observation work for very long at a time; otherwise the accuracy and completeness of the observation is bound to be reduced.

26. *There are certain things that powerfully attract attention and that must therefore be avoided in the effort to conceal information from*

the enemy. Prominent among them are movement, and change, intense stimuli, unusual things in familiar settings and familiar things in unusual settings. Railway and traction companies have found that a light or semaphore bar arranged to swing back and forth or to rotate makes the best warning signal at dangerous crossings. Crossing gates are painted in black and white diagonal stripes to catch the attention of careless drivers and pedestrians. Electric signs that flash on and off or that simulate movement are found to pay many times over for the cost of the apparatus for producing these effects. An old tin can makes an excellent blind for the termination of a periscope tube if located in an area generally strewn with such debris, but a lone tin can in the midst of a stretch of grass calls attention to its own presence. Many animals escape capture by keeping motionless when their enemies approach, and many others have given valuable suggestions to the camouflage corps by the manner in which their coloration permits them to efface themselves against a background with which they blend so beautifully. This general idea of "protective coloration," as it is called by biologists, is the idea underlying, for instance, the use of various sniper's suits which usually conceal their wearer from the enemy's eye, not by rendering him some uniform gray or "horizon blue" color but by covering him with splotches of broken color that give the effect of irregular light and shade on the background on which he is to lie or crawl.

27. *Whenever any interval of time elapses between the actual carrying out of observation and the recording of it by word or gesture or pen, the accuracy and completeness of the record tends to be reduced by errors of memory.* The original work of observation means, of course, that series of impressions that arise in the sense organs are carried to the brain where they leave some sort of trace, produce some sort of modification of the nervous substance. We know that this trace or modification is relatively unstable, that it tends to disappear, rather rapidly at first, then more slowly. You can recall now in considerable detail what you have been doing the last thirty minutes; tomorrow at this time you will be able to recall many fewer details; a year from now the doings of these last thirty minutes will have faded into oblivion unless some special occasion has led you to rehearse them and to keep the memories polished. Other things being equal, then, the longer the time has elapsed between your conversation and your recall of it, the less complete and the less trustworthy will be that recall.

28. *The most common inadequacies of memory are errors of omission.* Read the following paragraph *straight through two times*, then close the book and write as much of it as you can remember.³ Use the words of the original when you can, but use your own words if you can't remember exactly those you read.

THE DUTCH HOMESTEAD

"It was one of those spacious farmhouses, with highridged, but lowly sloping roofs, built in the style handed down from the first Dutch settlers, the low projecting eaves forming a piazza along the front capable of being closed up in bad weather. Under this were hung flails, harness, various utensils of husbandry, and nets for fishing in the neighboring river. Benches were built along the side for summer use; and a great spinning wheel at one end, and a churn at the other, showed the various uses to which this important porch might be devoted. From this piazza one might enter the hall, which formed the center of the mansion and the usual place of residence. Here rows of resplendent pewter ranged on a long dresser dazzled his eyes. In one corner stood a huge bag of wool, ready to be spun; in another a quantity of linsey-woolsey, just from the loom; ears of Indian corn and strings of dried apples and peaches hung in gay festoons along the walls, mingled with the gaud of red peppers."

This paragraph contains in all 180 words and approximately 94 distinct ideas. It will be found that no one can recall all of these ideas and that surprisingly large differences appear within any group of men that try it. It will also be found that the difference between the reproduction and the original lies almost entirely in the omission of ideas. The impressions made by the reading have faded or "shrunk," one might say, by an amount that varies with the relative capacity of the individual.

A similar experiment may be devised by substituting for the paragraph some large picture or photograph having a reasonable variety of detail in it.⁴ Examine this picture for some 20 to 60 seconds, then try to describe it so fully that a person who had never seen it would have a perfectly clear notion of its appearance. Tests of this sort may be elaborated by any one indefinitely; for

³ If this test is tried as a group, let some one keep the time and allow 2 minutes for reading the passage through twice and studying it in any way that is wished in what time may remain. Details for carrying out the scoring exactly are given in the writer's *Manual of Mental and Physical Tests*, Part II, page 120.

⁴ A colored lithograph entitled "A Disputed Case" is well adapted for this test. It is No. 1235 of the Taber-Prang Art Company's collection and may be purchased conveniently of the C. H. Stoelting Co., 3047 Carroll Ave., Chicago, Illinois. Another bit of material that may be recommended is a "Card of Objects" prepared by the present writer after suggestions by the French psychologist, Binet, and also sold by the Stoelting Co. Suggestions for using these test cards are given in my Test 32, *Manual of Mental and Physical Tests*, Part II, pages 22-29.

example, let three persons (strangers, of course) walk slowly past a group of observers; require from each observer as extended a description as possible of the three persons.

29. *The recall of what has been observed is liable to falsification by erroneous insertion.* If several observers try the experiment with the *Dutch Homestead* selection, it will almost surely happen that some one will add to his description details that were not present in the original paragraph. This type of mistake will usually be even better illustrated in the tests already proposed of describing a picture or a person from memory. Most of the insertions thus made will be found to be of the plausible sort, that is, they might quite well have been present in the thing or event under observation, and most of them will be found to relate to minor details. They represent, therefore, a tendency to fill out memories in such fashion as to make them accord with ordinary experiences. The main ideas are retained fairly accurately, but minor details are erroneously added that are not inconsistent with the main ideas, though they were not actually observed. From this it will be understood that these false additions are peculiarly serious when the observer is trying to recall something out of the usual run of his experience, for not only will he not have observed the details correctly (Principle 21), but he will unwittingly make absolutely wrong and misleading additions to his memories of what he did not observe correctly. And what is worse, he will not be conscious of the erroneous additions. The best way to meet this source of error in getting and reporting information is evidently to caution the observer to be on his guard against the tendency and to quiz him to determine just what items in his account he positively did observe and what ones he merely inferred to be present.

30. *The recall of what has been observed is liable to falsification by substitution.* This source of error is similar to that just described, only by substitution we refer to cases in which, instead of a simple addition of extraneous material, some of the original items are dropped and other items are inserted in their place. Many of the common alterations that characterize our accounts given from memory are of the general nature of substitutions. Thus, I once had an argument with a young lady about the possibility of "table-tipping." She told of a simple experiment that had occurred in her own parlor when, so she said, a half dozen persons were seated about

a light table and succeeded in making one edge of it rise an inch in the air by all concentrating their wills upon it. I expressed polite incredulity and suggested that such a thing might occur easily enough by unconscious pressures and pulls in the hands of the sitters. "That," the young lady retorted, "was impossible because when we exerted our wills upon the table, our hands were lifted off it." "Then I must really declare," I replied, "that your memory of the affair is at fault. You admit that it was several years ago." Whereat she exclaimed: "Here is where I convince you that other people besides psychologists know how to conduct experiments. I wrote down an account of it that very evening and I remember that I wrote about the hands being lifted in the air." She ran upstairs for her diary and finally produced her notes on table tipping, only to read in some dismay: "When the signal for exerting our will was given, we all laid our hands upon the table with little fingers crossing with our neighbor's so as to make a complete circle for the 'magnetism.' Pretty soon one edge of the table lifted several inches into the air!" Here the item "hands-on-the-table" was quite forgotten and there had become substituted for it the item "hands-lifted-in-the-air."

31. *The recall of what has been observed is liable to falsification by transpositions in the time, order and space arrangement of items.* Illustrations of these errors can be obtained by any person by reference to his own difficulties in giving a correct account of any series of events that occurred in rapid sequence. An excellent illustration is afforded in the accounts given in the court room by eye witnesses of an accident or of a street brawl. Absolutely contradictory answers are given by perfectly honest witnesses to such queries as: "Did the engineer apply the brakes before he whistled?" "Who struck the first blow?" "Was the accused standing in front of, or behind his brother?" "Which man went ahead and cut the wire?" "Did the explosion follow or precede the rocket signal?"

Here, again, as in other errors of memory, there is a strong tendency unwittingly to rearrange the order of events to accord with what would be the order under most circumstances. Hence the memory of a series of events that really occurred in a time order or in a spatial arrangement contrary to the usual order or arrangement is peculiarly liable to error.

32. *The omissions, insertions, substitutions and transpositions that affect the accuracy of recall are often quite unnoted by the observer.*

It may appear that this principle is self-evident, that if these errors were noted, they would not be made. In a way this is true, but it must be remembered that the recall of an event may take place with all degrees of confidence in its accuracy—from what is only a shade better than a guess to the most complete positiveness. Thus, a gap in the recall of a series of events might be without serious consequence provided its existence were known and mentioned—if, for instance, the report is made: "I have forgotten just what reply was made to the officer's question"—whereas the same gap might be of serious consequence if it were closed in memory—if, for instance, the report is made: "No reply was made to the officer's question." Similarly, with the other sources of error. The general principle involved is plain enough. What is wanted in a first-class observer is not necessarily a wonderfully detailed memory: rather a cautious memory, a recall in which the possibility of a slip of memory is always kept in mind and in which positive assurance of accuracy is made only with respect to those portions of the report that warrant this assurance.

These facts may be demonstrated by trying again any one of the several tests of memory previously described (the paragraph read, description of the picture or of the persons) and asking each participant in the test to glance over his written account and underline every statement to the accuracy of which he would swear were he testifying under oath in court. It will be unusual if more than half of the participants do not underline at least one statement that is factually wrong. The moral is obvious enough: if under these very favorable conditions—with complete understanding of what was to be done, with a warning as to when the object was to be observed, with no undue fatigue or emotional excitement, with no one to badger or hector by cross-questioning aimed to confuse, with a very short interval between observation and the recording of it—if, under these circumstances, almost every man is liable to swear positively that he recalls something that can be demonstrated to be wrong, then how inaccurate must be the memory of most men under the unfavorable conditions of observing and recalling events that we encounter in daily life, to say nothing of events that are encountered in military reconnaissance observation and patrol work!

33. *The correct recall of one feature of an object or event does not guarantee the correct recall of other features of the same object or event,*

even though these features seem logically bound up in one another. On one of the test-cards often used in laboratory experiments some half dozen different objects are pasted. Among these is a rectangular red label, having a narrow white border and the words "Handle with Care," printed in white letters. It happens often that observers recall that the label was red, but forget its shape; or that they recall that is said "Handle with Care," but report that these words were in black type. Errors of this sort seem almost illogical; that is, it seems as if a correct recall of the words must inevitably be associated with a correct memory of the color of type in which they were printed. But psychologically, it is clear how this last sort of error can occur: the observer may really bring to mind not the original visual picture of the label but his memory of the words as words.

Many people who are ignorant of these facts are too ready to accept the account given by an observer as accurate in its entirety because it is known to be accurate in all those details that are subject to verification. It is true, of course, that if an account states correctly let us say, 23 points with regard to a certain matter and there are stated two more points not open to verification, there is high probability that these two are also correct, but it is equally true that they *may* not be correct.

34. *When a number of persons report upon the same matter, those details upon which agreement appears may in general be considered as correct.* This principle may be demonstrated by reference to almost any of the experiments that have been suggested in the pages that precede. Go over, for instance, the reports made upon the contents of the paragraph, upon the picture or upon the appearance of the persons walking past. Note the statements made by all the observers, by 90 per cent. of them, by 50 per cent. of them, by 10 per cent. of them and by only one observer; see which ones of these statements are correct.

35. *But if a number of persons agree perfectly in their statements about numerous small details under circumstances such that observation must have been difficult and memory of them must have been likely to unintentional error, then suspicion is justified and collusion is probable.* Lawyers and court magistrates are well aware of this principle. When several witnesses tell precisely the same story of the scenes attendant on a riot or assault or murder, for example,

everyone conversant with human nature knows that this sort of agreement is contrary to expectation. It is almost a certain sign that these witnesses have talked over the matter beforehand and have agreed upon the story they have told, or it indicates that the later witnesses have been influenced by the earlier ones and are unable to separate their own memories of the original experience from their memories of what they have heard others tell about it. A corollary easily drawn from this principle is found in the following principle.

36. *When the truth is to be ascertained by the examination of several witnesses of the same event, these witnesses should be examined separately and if possible before they have been able to exchange ideas about it.*

37. *When information obtained by one person is communicated by him to another person a certain amount of inadequacy is almost invariably introduced by the very processes of communication.* Hand to several persons, separately, some familiar object, for instance, a jackknife, a blackboard eraser, a kodak print, a bunch of keys. Ask each one to describe the object so carefully that any one who heard this description would have as good an idea of the object as if he himself had seen it. Let each of the descriptions be listened to at the time or read afterward by another person; ask this last person to make up his mind very carefully just how the object will look, then show it to him and ask him if it differs in the slightest degree from his expectation of it. Was the inadequacy or the mistake due to the verbal description or to the hearer's interpretation of the description. Could it have been avoided? This test can be extended to objects or events of any degree of complexity. Thus, let a group of persons look out of the same window and let one of them describe out loud what he sees, hears, feels or smells, with the idea that he is to make his description as clear and as complete as he can. After, say, a minute of this, stop him and ask others in the group how they would have given the description, *i. e.*, in what respects they would have differed from the account they heard.

Simple experiments of this sort will bring out the following points. In these situations there is practically no reason for discrepancies due to faulty sense organs or distraction of attention or failure to understand what is being observed, nor is there any opportunity for omissions, additions, substitutions or transpositions attributable to faults of memory. Whatever discrepancies do

appear are due to the difficulty of "translating" the objects and events that are correctly enough perceived into suitable words—"suitable" in the sense that they succeed in arousing in the mind of a listener a reasonably complete picture of what is being described. The fault will usually be found to lie in both parties, in the person who is observing and making the statements and in the person who is listening and trying to comprehend these statements.

The same result obtains if the observer tries to use gesture or pantomime or drawings, instead of words or in addition to words, to convey his meaning.

It hardly needs to be added that when this task of communicating information concerns objects or events not under observation at the moment, but merely being recalled from memory, the chances for inaccuracy and incompleteness in the process of "reporting" (as the psychologist terms this process of translating into words) are decidedly increased.

38. *The most prominent inadequacy in description is incompleteness or simplification.* The description of an object is almost invariably simplified, that is, a considerable number of its features, often fairly important features, are not mentioned. It is to be noted that this is quite apart from the tendency to omission due to the fading of impressions in memory, for in such simple tests of ability to report as have just been suggested there is no call for the use of memory at all, but only for description. In one test of this sort conducted by the writer, a photograph was exhibited to a group of observers. Counting all the reports, 22 different objects or features were mentioned, yet the average number mentioned by a single person was only 9.4. Similarly, the French psychologist, Binet, had 150 persons describe a simple photograph and found no two of these descriptions were alike. In another test he asked 36 persons to describe a picture. Of these persons, every one mentioned the old man who formed the center of the group in the scene, but only 29 mentioned the fact that he was lying on a bed; only 27 mentioned a woman seated near him, while only 4 mentioned that one of the children held a stick in his hand. Here we have an illustration of the fact that the more prominent the feature, the more likely it is to be mentioned in any description. That is, the simplification that characterizes all report does not occur in a haphazard manner, but in accordance with a general tendency to put the greatest emphasis on what the observer feels to be most im-

portant and to pass by without mention what he feels to be unimportant. It will be evident, doubtless, how greatly training can improve observation and report in this respect. If the observer understands clearly that things that he once thought to be trivial and meaningless have a high degree of significance, he no longer passes these by without mention.

39. *The attempt to label an observer as belonging to a certain "type" on the basis of what he does in a preliminary trial is of doubtful utility. It is more important to determine his susceptibility to improvement by training.* Students of human nature have sometimes attempted to classify men with respect to their tendencies to report what they have observed in this or that characteristic way. Thus, descriptions have been sorted as displaying predominantly imagination, moralizing, emotional reaction, erudition, simple enumeration, etc. Note, for instance, these two descriptions of a cigarette:

"The cigarette before me has the general form of a cylinder cut at one end by an inclined plane where the paper is folded. The paper, which is striped lengthwise, is somewhat bruised. The tobacco projects about 0.5 cm. from one end," etc.

"We have before us here a cigarette. Let us see how it is made. In the first place the exterior envelope is of light paper, called silk-paper. Then, inside is the tobacco. Tobacco is a product that grows almost everywhere in warm or temperate climates. The leaves of this shrub are gathered, and, after a treatment that lasts four years, are turned over to the public in the form of powder, that is, snuff, or in shreds, as in the present instance," etc.

The first description is listed as the work of a "describer" or "enumerator" because it merely catalogs the features of the object with little attempt at explanation or interpretation. The second description illustrates the work of the "erudite" individual, who tells what he knows or has been taught, rather than what he observes. However, it remains to be determined whether the person who wrote the second description might not write an equally straightforward enumerative sort of description, like that of the first person, if he understood that that was the kind that was wanted,—at least after one or two trials under training and correction.

It will be seen from this comment that one cannot determine by any sort of offhand test what ability a man might demonstrate in a given line of military observation. It was reported early in the war, for instance, that a certain officer engaged men in conversation while he walked down the aisle of a department store with them and then recommended their rejection as aeroplane observers if, without previous warning that they were under test, they could

not give a clear account of the goods displayed on the counters of the store. This story may have no foundation, but if true, it is an excellent example of how dangerous lack of elementary psychological knowledge may be. Failure to pass such a test would indicate nothing of lack of capacity to be trained for military observation. In fact, if it showed anything, a poor score in such a test would simply show that the listener gave such close attention to the officer's remarks as to be oblivious to the mercantile appeal of the bargain counters. Presumably such a man would make good material for training.

We are reminded in this connection of the pompous English school inspector mentioned by Adams, I think in his *Herbartian Psychology Applied to Education*, who asked a class of pupils: "Children, at which end does a recumbent cow begin to arise?" and who, when no response was forthcoming, proceeded to reprimand the trembling teacher for not having taught her charges the fundamental need for comprehensive and accurate observation. What she ought to have said to squelch the inspector was: "Who cares how the recumbent bovine begins to arise, and how does failure to have remarked her *modus operandi* in assuming an erect posture demonstrate that my children cannot observe properly on occasion?"

From what has just been said it must not be supposed that individuals do not display conspicuous and more or less persistent differences in their types of description. They do show these differences, only the differences may be to some extent reduced by special training, and are not in any event to be assumed present on the basis of a single trial under artificial and not clearly understood conditions.

40. *The range and the accuracy of an observer's report depend partly on the form in which it is made, especially whether it be a free, spontaneous account (narrative) or in answer (deposition) to a series of questions (interrogatory).* By a "narrative," in this special sense, we mean a free account, either oral or written, delivered by the observer without comment or suggestion from the person to whom he is reporting. By an "interrogatory" we mean a series of questions designed to probe the observer's memory and to bring out a series of replies concerning the matter in hand. The answers to these questions, we term a "deposition." Of course, the interrogatory may be used alone or it may be used to supplement and to make clearer the statements of the narrative.

Each form of report has its advantages and its disadvantages. Thus, it will be evident that the narrative has the advantage of spontaneity; the observer follows his own trend of ideas and is not influenced in his formulation by any interjections, interruptions or quizzings by those to whom he is reporting. On the other hand, experience shows that the narrative is always of less range than the deposition; that is, the number of items or features that will be voluntarily mentioned, the amount of detail that will be spontaneously reported, is always less than the observer really observes and that he could report accurately in response to properly directed questions. But the corresponding advantage of the deposition, that is, its superior range, is purchased at the expense of a possible disadvantage, because the questioning, as will be shown in a moment, always has a tendency to elicit replies that are less accurate than the statements made in the narrative. Ordinarily, therefore, the observer ought to be permitted to make his own report first and to be interrogated afterward if this narrative is inadequate in scope or obscure in details.

41. *Items recalled by interrogation, though unmentioned in the narrative may often be reported as accurately as other items that were mentioned in the narrative.* It might seem at first thought that if an observer had noted a certain thing so clearly that, on interrogation, he can give a circumstantial description of it, he would naturally have mentioned it in his original recital. The fact is otherwise. It is true that questioning is liable to suggest to the observer matters that he had not observed clearly and that he is liable to make an inaccurate reply about such matters or that he may try so hard to answer every question that is put to him that he may unintentionally falsify. But, on the other hand, there will be a certain percentage of matters that he really did observe clearly and to which he can reply accurately that will be brought out only by the questioning. These matters may have simply slipped his mind when he gave his free version of what he observed and it needs only the barest mention of them to bring them back fully to his memory. Or he may have thought of them but have omitted to speak of them because he felt that they were unimportant.

These principles may be demonstrated by questioning several men who have tried one of the experiments in report that have been suggested in the earlier pages of this Section. Let the narrative be recorded; then quiz the men concerning items they have omitted,

e. g., "Was anything said about fish nets in the description of the Dutch homestead?" "Was there a piece of paper on the floor of the room you are describing?" etc.

42. *The amount of error in the deposition depends much on the skill with which the questions are framed: it is considerably increased if the interrogatory contains suggestive questions.* Everyone knows that a skillful questioner can go far toward bringing out replies of the sort he desires. Lawyers who wish to trap a witness into making a given statement often resort to "leading" questions unless the opposing counsel or the judge raise objections. If an officer is "pumping" a patrol leader for information he has no wish, of course, to encourage inconsistent or false statements, yet he runs that risk if he is not careful of the way he puts his questions.

Of the various types of questions it is worth noting a few of the most common.

The questioner ought, therefore, to be familiar with a few of the most common types, or forms, of questions and to know roughly which of them is the least, which the most misleading to the reporter.

Let us suppose that the reporter is being quizzed about a picture in which there was a brown dog but no cat.

(a) The question: "What color is the dog?" carries the least amount of suggestion. The reporter is free to mention any color. Questions thus introduced by a pronoun or by an interrogative adverb may be called *determinative* questions.

(b) The question: "Is there a dog in the picture?" is a *completely disjunctive* question. It forces the reporter to choose between two alternatives.

(c) The question: "Is the dog white or black?" is an *incompletely disjunctive* question. It offers the reporter a choice between two alternatives, but does not preclude a third possibility. Under the circumstances we are assuming, this question would be distinctly a suggestive and misleading question. The reporter can, of course, reply: "Neither, it is brown," but this reply necessitates a certain degree of resistance to the suggestion that the dog is either white or black.

(d) The question: "Was there not a cat in the picture?" is termed an *expectative* question. It obviously arouses a fairly strong suggestion that the answer is to be "Yes."

(e) The question: "What color is the cat?" would be an *im-*

plicative question under the conditions we are assuming, because it implies the presence of a feature that was not really present in the experience. Its suggestiveness is usually much stronger than that of the expectative or disjunctive type of question; that is, for the average observer, if he is not certain whether the cat was there or not, it is much harder to say "There was no cat" in answer to this question than in answer to the question: "Was there a cat in the picture?"

It would be well for students to practice the phrasing of questions relating to some experimental situation. Let one member of a class observe a large complex picture⁴ or a group of objects on a table or a bit of terrain containing numerous features of military significance. While his eyes are closed let other members of the class practice in quizzing him on what he saw, aiming now to produce suggestion, now to avoid suggestion, as may be directed. Let others criticize the formulation of the questions in the light of the aim of the questioner.⁵

The actual degree of influence exerted by suggestive questions may be indicated by some quantitative results obtained by Binet with his "Card of Objects" test. With indifferent (non-suggestive) questions he obtained 26 per cent. of error, with moderately suggestive questions (mostly of the expectative type) 38 per cent. of error and with strongly suggestive questions (mostly of the implicative type) 61 per cent. of error. These figures pertain to results with children, who are well known to be more open to suggestion than are adults, but the relative influence of the different types of questions may be deemed about the same for children and adults.

43. *If by an error is meant any distinct discrepancy between items reported and the actual facts, it may be laid down as a rule that, even in the case of competent adults, observing and reporting under favorable conditions, an errorless report is the exception. On the contrary, if the report attempts to get down to details, the average reporter will make a score of about 75 per cent. in accuracy, not counting omissions as errors. This statement is based upon repeated trials under experimental control in the psychological laboratory. In such*

⁵ If the lithograph previously suggested, known as "The Disputed Case," or if the Binet "Card of Objects" are either of them available, questions of varying degrees of suggestiveness will be found on pp. 23-24 and 27-29 of the writer's *Manual*, Part II., Test 32.

trials the conditions are uncommonly favorable—the observer knows what he is to observe, when it will appear, how long it will be perceptible, and understands that he is to make a report almost immediately afterward. Observers who must do their work under markedly less favorable conditions certainly cannot be expected to make much better scores.

The few exceptional reports that are errorless are usually found to have only a very small range. That is to say, it is possible to make a score of 100 per cent. in accuracy by refusing to make any statement that is not felt to be positively correct. Indeed, in some instances of this sort that have come to my notice, the report was so much restricted in order not to make an error that it was almost valueless as a conveyor of information.

The practical significance of this principle is that every piece of testimony must be accepted with caution. If you are an officer and if your men make to you a series of reports that run at all into detail, you may be sure that the chances are better than one to one that there is at least one mistake in each man's report.

44. *If the various items that constitute a report are sorted by the reporter into groups according to the degree of certainty he feels as to their accuracy, then the items in the group characterized by the highest degree of certainty will be found to be distinctly more accurate than those placed in other groups, but a first-class, highly trained observer will at times be absolutely wrong with respect to statements to which he attaches the highest degree of certainty.* In illustrating Principle 32 (that slips of memory are often unnoticed) it was suggested that the report of the paragraph read or of the picture or persons seen be marked to show what items would be sworn to as correct, with the reporter giving testimony in court under oath. It is to statements like those underlined in that experiment that we refer to as "items in the group characterized by the highest degree of certainty." In laboratory experiments, when all statements are divided into two groups—those "sworn to" and those not—the items in the former group usually contain about 10 per cent. inaccuracy as over against some 20 to 25 per cent. inaccuracy in the latter group. It is possible to distinguish more than two degrees of certainty; it is not difficult, for example, to grade each item in your report on a scale of five points: (1) absolutely positive, (2) very certain, (3) fairly certain, (4) doubtful, (5) little better than a guess. If this is done by the members of a class and if the number

of errors are counted for items reported with each of these five degrees of certainty, it will be found that the proportion of errors tends to increase as the degree of certainty decreases.

The practical application of this principle is not far to seek. Men who are being trained for work in intelligence sections ought to understand thoroughly that error tends to be inversely proportional to certainty, and they ought to be encouraged to qualify their reports by indicating the degree of certainty attaching to important items. Thus, their reports should contain such phrases as: "I am positive that" so and so; "I am fairly sure that" so and so; "I am inclined to think" so and so; "I overheard only snatches of conversation and can only hazard a guess that" so and so.

45. *Estimates of distances, heights, angles, numbers and dimensions of objects are open to considerable inaccuracy and are often subject to constant tendencies to over or underestimation.* It is rather hard to lay down precise rules to cover the detailed application of this principle; so much depends on special conditions. But in general we find that short time-intervals (in the neighborhood of one minute) are strongly overestimated; intervals of medium length (about 10 minutes) show no overestimation, while longer intervals (30 minutes) are usually underestimated. Short distances (2 or 3 meters) and long distances (over 100 meters) are usually somewhat underestimated, while medium distances (around 20 meters) are often overestimated. The angular grade of hills and roads is strongly overestimated. All these and similar estimations, like estimates of the number of men in a crowd, are considerably affected by the accident of their relation to the nearest "round number," or rough unit of estimation. Thus, a person weighing 208 pounds and another weighing 194 pounds, if estimated singly, are very likely both to be set down by most estimators as weighing 200 pounds, that being the nearest convenient round number, so that the former's weight will be consistently underestimated, the latter's consistently overestimated. In the same way a stretch of time is more apt to be reported as five minutes than as four minutes or six minutes.

It will be seen from these considerations that in this matter of estimating quantities agreement among witnesses may mean little. In this case it is not true that the report given by the majority of witnesses is almost certainly correct. For example, if a series of striking events occurred in rapid succession that occupied just one

minute, it is not likely that any participant would estimate their duration at less than five minutes.

The way to meet these difficulties is evidently to practise the men selected for observation in the making of all the estimates that they are likely to have to make in their work. The intelligence section, for example, ought during its period of training to make frequent trial in estimating distances, numbers of men grouped in the distance, etc., with immediate correction by the officer in charge. As, for instance: "How far from here to that tree stump?" "Forty paces." "No, sixty five paces; walk over there and back and get the feeling of sixty five paces fixed in your mind." "How many men are seated on the ground at target practice?" etc.

There is some ground for believing that persons of poor culture, unless their occupation has led them to receive special practise in this sort of work, are distinctly inferior to persons of good culture in all sorts of estimations. It would certainly seem probable that the possession of a good degree of general intelligence would be a helpful aid in the quick response to training in the making of accurate estimations.

GENERAL REVIEW AND SUMMARY

READING

BY E. H. CAMERON

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The larger number of investigations of reading in the past two years have been concerned with the devising of tests and the results of their application to school children.

The relation between speed and quality of reading has been studied by King (4), (5) and Peters (7). The former finds little ground for the view that the efficiency of fast readers is greater than that of slow readers; and the latter, that increased speed does not necessarily carry with it any increase in efficiency. On the other hand, Peters finds that 18.7 per cent. of pupils gain in both speed and effectiveness by special speed drills.

Whipple and Curtis (12) investigated the capacity of six university students to reproduce material read by the process of skimming at normal and forced rates. The slowest readers were found to be the poorest reproducers, and the best reproducer was a fast, but not the fastest, reader. Fast skimming is correlated with poor reproduction. The natural rate of skimming is correlated with that of reading, and the conclusion is drawn that skimming should be taught.

Thorndike (10), (11) has studied the process of acquiring meaning in reading by a study of answers to questions on the material read. He finds certain words to be overpotent and others underpotent in their effects. When errors occur, elements have become dislocated, or connections are wrong or inadequate. Reading for content is essentially thinking, and the results show that reasoning is explicable on the basis of the general laws of habit.

Mead (6) finds that 70 per cent. of pupils investigated reproduce material read silently better than material read orally.

A revival in interest in the study of eye-movements in reading is evinced in the work of Schmidt (8) and Judd (3). Schmidt used the Dodge method in comparing the eye-movements in oral and silent reading. He found that the pauses are more frequent and of

greater duration in oral reading, as well as that the perception time is significantly greater.

Judd's important monograph is a comprehensive study of reading from the genetic point of view. Besides the editor's independent work it utilizes the work of C. T. Gray (1), W. S. Gray (2), Schmidt (9) and others. The eye-movements of both adults and children, good and poor readers, have been studied in both silent and oral reading. Experimental methods of training children who are backward in reading are described.

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SPECIAL REVIEWS

The Stanford Revision and Extension of the Binet-Simon Scale for Measuring Intelligence. L. M. TERMAN, GRACE LYMAN, GEORGE ORDAHL, LOUISE E. ORDAHL, NEVA GALBREATH AND WILFORD TALBERT. Baltimore: Warwick & York, 1917. Pp. 179.

A Scale of Performance Tests. R. PINTNER AND D. G. PATERSON, New York: Appleton, 1917. Pp. ix + 217.

The Picture Completion Test. R. PINTER AND MARGARET M. ANDERSON, Baltimore: Warwick & York, 1917. Pp. vii + 101.

The Mental Survey. R. PINTNER, New York: Appleton, 1918. Pp. v + 116.

These four books represent the best type of recent work in the accurate standardization of mental tests. The technique of standardization is a very recent development. One has only to compare the elaborage and careful work on the Stanford Revision, which is described in Terman's manual, with the comparatively crude method by which the original Binet Scale was constructed to realize the advance which has been made in the past ten years. The Stanford investigation stands preeminent in the testing movement as a piece of standardizing work. It was carefully and adequately planned after preliminary experience, the subjects were numerous and representative, and the material of the scale was worked over on the basis of the results until the scores met the requirements of an accurate, relatively final standard. The standardization was not left in tentative form, but was worked over until the median of unselected children tested at the age corresponding to their chronological age. This investigation stands as a model in this respect and as an example which other investigators would do well to follow. Even the careful and ingenious work of Pintner, represented in the other books under review, is marred by the fact that it stops short of this completeness of standardization. It is legitimate to put out results as tentative when it is necessary to get the coöperation of other investigators in order to check them up, but when the investigator has the material in his own hands to carry the work forward to completion it is a pity when he does not do so before publishing

them. Pintner has carried his work so much further than have most investigators, and has displayed so much skill in the statistical formulation of his results, that we may well demand of him the one final step necessary to complete standardization. This applies particularly to the Scale of Performance Tests, which might have been standardized by determining the arrangement or method of scoring which would make the median unselected child test true to age.

The readers of this journal do not need to be introduced to the details of the Stanford revision. It is a radical modification of the Binet Scale. The old tests and many new ones were standardized by giving them to about 1,000 children in a middle class community. The final scale numbers 90 tests as compared with 54 of the Binet Scale. The scoring is modified so as to read in months of age, and the various factors which make up the score have been adjusted empirically in order to make the scale true. These factors are the number of years for which tests are furnished, the number of tests for each year, the score value of each test, and the hardness of the individual tests as measured by the percentage of children passing it at the age at which it is set. These factors, which may be modified so as to make the scale harder or easier, were changed three times, and each time all the records were scored, before the results were satisfactory.

Terman takes the opportunity in this monograph to discuss problems relating to the validity of the general organization of the age scale, particularly as compared with the so-called point scale, and questions relating to the interpretation of the scores, and to norms. With reference to the age principle the author clearly indicates that it is only a question of method. A point scale uses the age development principle in its norms, and an age scale can be made into a point scale by putting its scores into the form of ratios. The age scale as at present constructed has the advantage in that the weighting of the different tests is determined empirically rather than arbitrarily. The interpretation of the scores is involved in the question of norms. Sex differences are not great enough to require separate norms. Whether social differences require different norms depends on whether they are due to environmental or inherent differences. They are probably in part at least inherent, and therefore do not require as widely different norms, as is indicated on the face of the scores.

Pintner and Paterson's *Scale of Performance Tests* is constructed

for the purpose of making it possible to test children who cannot be tested by the Binet Scale on account of language limitations, or to supplement the Binet Scale. The tests are chiefly of the form board variety, with the addition Healy's Picture Completion Test, the Substitution Test, Goddard's Adaptation Board, and the Knox-Pintner Cube Test. These tests were given to from about 650 to nearly 1,000 children each, and were scored for time and errors. Time and errors were used separately for the norms. The results are worked up so as to give three kinds of scales, an age scale, a median age scale, and a point scale.

The age scale is similar to the Binet scale except that instead of scoring each test for the most part by the pass or fail standard and then assigning a test to one mental age, several age standards are laid down for each test by determining a range of scores to correspond to each age. This range consists of all the scores between that attained by 75 per cent. of the children of the age in question and the score attained by 75 per cent. of the children of the next higher age. The 75 per cent. standard is adopted on the theory that it will include all the scores made by the middle 50 per cent. of children of a given age and hence all those who are to be reckoned as normal. Theoretically it is probably better to standardize the scores for individual tests by assigning to a particular age the score made by the median child of that age, but the question is not simple.

After the age scores for the individual tests are determined they are put into three kinds of scales. The first is an age scale of the same sort as the Binet Scale. Since there are not an equal number of tests for each age the tests for a particular age are weighted by giving each test a value equivalent to its ratio to the total number of tests for the age. Thus if there are ten tests for an age each test has the value of one tenth year. With this qualification the scoring is done as in the Binet Scale.

The second scale, which the authors recommend, is a median age scale. According to this method a child's mental age is first determined in each test individually and then his total or true mental age is found by taking the median of the individual mental ages. The calculation is thus not affected by the number of tests which are used for each mental age nor by the number which are given the child, so long as there are enough to make an adequate test.

The third scale is a point scale. The chief problem here is to determine how many points should be assigned to each test. The authors adopt the method, which they recognize as not very satis-

factory, of assigning approximately the same number of points to each test. They then, on the basis of the age progress curve, count somewhat arbitrarily the number of discriminative steps in the entire scale of performance which appear, and assign to each discriminative step the score which is found by dividing the total score by the number of steps. Since the process is not recommended by the authors themselves it is not necessary to describe it further.

Specimen record blanks, and the records of two children based on the three performance scales and the Binet Scale are given. There is considerable discrepancy between the rating by the different scales but the authors do not determine which is the truest.

The standardization of the picture complexion test is a very elaborate and complete piece of work. Every move made by a large group of children was recorded and the percentages of the various moves were calculated. These percentages were used as the basis of the weighting of the various moves in scoring them. Instead of arbitrarily deciding that certain moves should be given full credit, others partial credit and still others no credit each move which occurred at all was rated as deserving an amount of credit proportional to the number of individuals who made it. After all the moves were thus rated it became a simple matter to calculate an individual's score by adding the credits of all the moves which he made in placing the blocks. This empirical method of standardization, while it may require modification in detail, is in principle much superior to the a priori method which has been much more frequently employed. After determining the method of scoring the authors calculated the ten percentile scores of the children of each age. This makes it possible to use the test in scales in a variety of ways. It is a method which was introduced into the field of tests by Mrs. Wooley and promises to be very serviceable.

Pintner's *Mental Survey* was prepared to be a manual for group testing. A small group of tests, most of which were included in Pyle's manual, have been standardized by the ten percentile method. The method is an excellent one and it is very desirable that it be extended, but it would have been more suitable to put out the present list as an illustration of the method than as a manual. Before a manual is put forth a more extensive and careful selection of tests should be made. Some of the tests included in the present list are of little value and others of greater value might have been included. Premature publication of a manual for general use leads to the dissemination of error through faulty experimentation by

persons who are not qualified to criticize their method of procedure. Furthermore, in view of the present scarcity of labor and materials it is more than ever necessary to make sure of the serviceableness of a new and expensive book before publishing it. The material of this book would be valuable as an inexpensive technical monograph, but not as an expensive manual for general use.

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NOTES AND NEWS

DR. H. E. BURTT has been appointed instructor in psychology at Harvard University.

DR. JOHN J. TIGERT, head of the department of psychology at the University of Kentucky, has been granted leave of absence and will go at the close of this year to France into Army Y. M. C. A. work.

UNDER date of May 11 the President has issued an executive order requesting the National Academy of Sciences to perpetuate the National Research Council with specific mention of the following duties: 1, to stimulate research; 2, to formulate comprehensive projects; 3, to promote coöperation in research; 4, to bring about coöperation of investigators with the War, Navy and other civil U. S. government departments; 5, to direct attention to the importance of military and industrial problems; and 6, to gather and disseminate scientific and technical information to those duly accredited.

THE
PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES
THE NEURONE

BY H. B. FERRIS

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The controversy as to the relationship of the endocellular network of Golgi (Binnennetz) and the trophospongium of Holmgren still continues. Ross (15) from his work on the nerve cells of the crayfish concludes that the trophospongium is a framework in the perikaryoplasm extending in from without and is non-nervous; and may contain nuclei and occasionally blood capillaries and serves both a nutritive and supporting function. Holmgren believed that Golgi's reticular apparatus and his trophospongium were identical and that the Saftkänalchen are developments by a dissolution process of the trophospongium. Ross thinks that the trophospongium is not only not identical with the reticular apparatus but entirely unrelated to it.

Cajal (1) studied the effect of experimental traumatism of the cerebrum on the reticular apparatus in the cortical cells. He found that an incision in the brain brings about complete destruction of the net only in those cells most severely injured. The net in cells near the incision while deformed in some instances showed no noteworthy abnormality. He thinks that this indicates that Golgi's net has considerable fixity of structure and firmness of texture since if it were of fluid consistence it would be found dispersed through the perikaryoplasm or massed together into larger droplets. Cajal also shows that the section of a peripheral axone has no effect on the structure of the Golgi apparatus. He believes that the Golgi net represents a canalicular system filled with a lipoid-containing substance reacting to silver impregnation and that these canals are for the most part fixed.

Pappenheimer (13) believes that the Golgi apparatus, Nissl bodies and mitochondria are different entities as they can be stained

in the same cell. As yet, however, no one has observed the net in the living cell. The Golgi net has been found in nearly all kinds of cells including those of the embryo and is described as breaking into fragments during mitosis and distributed evenly to the daughter cells. The net exhibits polarity, being found on the side of the nucleus toward the free surface and away from the blood supply. As fragmentation of the net occurs in ganglion cells after section of the axone, which however is denied by Cajal, and in lead and strychnine poisoning and traumatic injury, he believes that the net may be of solid form. Because of the capricious action of silver impregnations a new method of staining and more experimental work are needed to solve the morphology and genetic relationship of Golgi's reticular apparatus.

Little has been added recently to our knowledge of Nissl substance. There does not yet seem to be any absolute certainty as to whether this material exists in the form in which we find it in fixed and stained sections or whether it is simply a precipitation product. However, even if the latter supposition be true, it represents at least a chemical differentiation of the perikaryoplasm. Some observers claim that they can see Nissl bodies in the living cell, while others deny their existence there. Substances closely allied to these bodies have been found in many kinds of cells other than nerve cells and to such materials including Nissl bodies the general term chromidial substance is applied. Chemically Nissl bodies are generally believed to be a nucleo-protein containing iron which is elaborated by the nucleus.

Cowdry (3) has tried to solve the riddle of the "chromophile" cell at least as far as its finer morphology is concerned. He studied this condition in white mice and finds that chromophile cells vary in structure. Usually the cell as a whole and also the nucleus are shrunken. In some cells the mitochondria are increased either in number or sometimes as a diffuse material. As a rule no corresponding change in Nissl substance is noted, and Golgi's reticular apparatus seems to be unchanged.

Cowdry discovered some interesting facts relating to the distribution of the chromophile cells. They may exist singly or in groups of varying size in all stages of the chromophilic condition with unaltered cells scattered among them. He found chromophile cells more abundant in the cerebral and cerebellar cortex than anywhere else, rarely present in the olfactory bulb, corpora striata, thalami and cord, and infrequent in the medulla and the cranial

and spinal ganglia. He concludes that the chromophile condition is not an artefact but can be seen in the fresh cell where the material exists in the fluid state and can be stained vitally by methylene blue and that it is not associated with a pathological change in the animal. As chromophile cells are found in young mice as well as adults he considers that they are not an expression of senility.

The observations of Flesch (7) on chromophile cells do not wholly accord with those of Cowdry. Flesch finds more chromophile cells in all animals in the cells of the Gasserian ganglion than in the spinal ganglion and that chromophile cells are larger than the normal cell. Also he finds chromophile cells are less in number in young animals than old. As the nerve cells of the embryo are exclusively mesochrome he believes that both chromophobe and chromophile forms are derived from the mesochrome.

During the last three years there has been an intensive study of the mitochondria by various observers. Duesberg has suggested in order to clarify the nomenclature that the term chondriosomes be adopted as the general term instead of mitochondria, which is reserved for the granular form while the filamentous form he calls chondriocontes. In studying the nerve cells of fish embryos he finds chondriosomes in the form of granules already uniting to form filaments parallel to the long axis of the cell as early as three days after fertilization. Meves and Duesberg believe that in cell division there is an equal partition of chondriosomes between the two daughter cells.

The Lewises (II) have given a very interesting account of the mitochondria observed in the living cells of the chick in cultures. They find that the mitochondria may be evenly scattered through the perikaryoplasm or radiating around the central body or at one side of the nucleus. They change shape, size and number, even branching and forming a network, and move about passing from one cell to another through anastomosing processes and migrate from nucleus to periphery and return. An increase in size and number occurs during the growth period and just before mitosis. They are of the opinion that the mitochondria have a somewhat characteristic appearance in the different kinds of cells and in the nerve cell are more likely to be small granules and short rods. CO_2 and acids cause them to degenerate, heat causes them to change shape and decrease in number, alkalies and hypotonic solutions cause them to swell, hypertonic solutions shrink them and chloroform and ether dissolve them. They found no evidence that either glycogen granules

or fat droplets are formed from them or that they divide during mitosis or are evenly distributed to the daughter cells as some observers describe. There is some evidence that mitochondria decrease as nerve cells become senile and as the result of fatigue.

Nicholson (12) thinks that there are differences in quality and form in the mitochondria in different cells of the central nervous system of white mice. In the cerebral and ventral horn cells they are filamentous, while rod-like and granular forms are characteristic of the cells in the mesencephalic nucleus of the 5th nerve and the Gasserian ganglion. Also in the same cell they are more likely to be granular near the nucleus and always elongated in the processes. They may lie between the Nissl bodies or be buried in them. Also there are microchemical differences as some are more readily soluble in acetic acid than others. In view of the work of the Lewises, who have shown that mitochondria are constantly changing in shape, one is sceptical of the significance of these differences described.

Thurlow (17) studied mitochondria in motor and sensory cells but found no characteristic differences. Some sensory cells contained more mitochondria than motor cells and others less. The number of mitochondria however in the cells of the same group were about the same and he believes that there is a definite mitochondrial cytoplasmic ratio.

Little is known of the relation of mitochondria to diseased conditions. They may have some relation to fatty degeneration as they have been shown to have some connection with the formation of fat droplets in phosphorous poisoning. As cholin is found in the cerebro-spinal fluid in organic in contradistinction to functional disease of the nervous system there is some evidence that the mitochondria are connected with its formation, Cowdry (4) suggests that a study of the mitochondrial content of nerve cells in disease of the nervous system may yield valuable information.

The evidence from various sources seems to show that mitochondria are definite, discrete, formed elements found in all kinds of cells and at all ages and chemically are a lipoid albumen. They are not related genetically to the neurofibrils, Nissl bodies nor the Golgi net. Functionally they are connected with the fundamental metabolic processes such as occur in all cells, possibly of a respiratory nature. They are therefore less specific substances than Nissl bodies or the neurofibrils.

Turning to more general facts about the neurone Carpenter and Conel find in sympathetic ganglia not only Dogiel's motor type of

cell with thick dendrites but also his sensory type with slender dendrites. As they also find the intermediate type, they conclude that Dogiel's types are only the extremes of the variations occurring in multipolar sympathetic cells.

Greenman (8) finds that the number of fibers in the peroneal nerve of the albino rat increases with age until 250 days is reached and the number begins to decrease after 335 days of age. Also the sectional area of the fibers decrease with advancing age. Electrical stimulation has no effect on the sectional area of the nerve fibers.

Ransom (14) has shown that in spinal ganglia there are all sorts of variations from the fundamental type of cell with T-shaped axones and that simple unipolar cells may be transformed under experimental conditions into complex multipolar cells and such cells may return to their original simple form. This brings up the question of the possibility of the individual neurone in situ changing its form.

There has been a renewal of the attempt begun a number of years ago by Hodge to try to correlate the various structures in the nerve cell with their function. Smallwood and Phillips studied the size of the nucleus in the nerve cells of the antennal lobes of the bee and found that the nuclei vary greatly during all the stages of the bee and therefore question the validity of Crile's conclusion that the nuclei of nerve cells are smaller in shock and Hodge's conclusion that they are smaller in fatigue.

Dolley (5) and his pupils in various papers have tried to show a correlation between structure and function in the Purkinje cell of the cerebellum. Dolley holds that there is a constant relation of the volume of the nucleus to the volume of cytoplasm in the resting cell. The relation he calls the nuclear-plasma coefficient $\frac{\text{volume of cytoplasm}}{\text{volume of nucleus}}$.

He contends that the resting cell of Purkinje has no basichromatin except in the karyosome, that the plasma shows no edema nor vacuolation and also that there is a certain mass relation of nucleus to cytoplasm. During activity the cell and nucleus shrink, the chromatin decreases and there is an "upset" of the nucleus-plasma relation in favor of the nucleus, *i. e.*, nucleus is relatively large, and a dissolution of Nissl bodies occur. The coefficient continues to decrease as activity proceeds.

Kocher (10) studied the effects of activity on the cells of the motor cortex, in the spinal cord and cerebellum in dogs and cats in carefully controlled experiments. He was unable to find any of the various changes described by Dolley as resulting from fatigue, such

as changes in Nissl bodies, changes in actual size or relative size of nucleus or in any of the other constituents of the nerve cell. The impartial observer apparently must reserve for the present his judgment in the matter.

Kappers (9) in a long article defends his theory of neurobiotaxis. This theory assumes that the chief dendrite grows out toward, and its cell body shifts toward, the direction from which the stimulus proceeds, provided that the stimulation is of a nature that these cells respond to, *i. e.*, a correlation exists. He considers this growth of dendrites toward the source of stimulus (stimulo-petal tropism) similar to a kathodic tropism and the growth of the axones away from the stimulus (stimulo-fugal tropism) similar to an anodic tropism.

This theory is an attempt to explain the growth of the dendrites in one direction and the axone in the opposite and the shifting of groups of cells which occur during development. He concluded that correlated function is the fundamental factor in the arrangement of the cells and axones in the nervous system. The theory of neurobiotaxis seems more like a statement of an observed phenomenon than a satisfactory explanation of it. The anatomist has now brought our knowledge of the internal morphology of the neurone to the point where the assistance of the biological chemist and the pathologist is needed to increase our knowledge of the relation of structure to function.

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REFLEX MECHANISMS AND THE PHYSIOLOGY OF NERVE AND MUSCLE

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The posthumous book of Keith Lucas (13), in Starling's Monograph series, has been arranged for the press by E. D. Adrian from manuscript left by the author. It sums up in very clear form the recent work on the conduction of the nervous impulse and gives what is virtually a digest of the brilliant investigations of Lucas and Adrian themselves. Their chief experimental device for measuring the intensity of a nervous impulse has been to "set it to face a tract of nerve in which it will undergo a decrement, and determine how far it is able to travel before it is extinguished." Such a region of decrement can be produced by narcotics and by other means. This method seems to have yielded a final demonstration of the all-or-none law for normal nerve fibres, and the authors conclude that, "when a motor nerve is artificially excited with stimuli of varying strengths, the graded contraction of the muscle results solely from variation in the number of fibres brought into action." The separate contraction of isolated muscle fibres has now been

directly observed by Pratt (16) and Eisenberger (3). Under three circumstances, however, the nervous impulse is susceptible of quantitative variation: first, in a region of decrement, where as it travels it is gradually reduced in intensity and may be extinguished; second, if it comes so immediately after a preceding impulse as to be travelling always in tissue which has been left in the "relative refractory" state by the preceding impulse. Here, "the impairment in conduction is of a different kind from that brought about by a narcotic. The nerve does not conduct with a decrement, but it will not conduct impulses of the normal intensity." The third case is that in which a (slightly later) second impulse is traveling in tissue which a preceding impulse has left in the "phase of supernormal conduction." For the process of recovery in nerve after the passage of an impulse presents three stages—the absolute refractory, the relative refractory, and the supernormal.

The authors favor the "hypothesis" that summation in nerve depends on this phase of supernormal conduction. A second, supernormal impulse will be able to travel through a region of decrement in which the preceding impulse (of merely normal, "all-or-none" intensity) was extinguished. And Lucas regards the myo-neural junction as a region of decrement, for "the supposition of a decrement in conduction is the only hypothesis yet put forward which gives an account of all the known phenomena of conduction in the junctional tissue between nerve and skeletal muscle." Inhibition is explained by means of the reduction that an impulse suffers when it is timed to fall in the relative refractory phase left by a preceding impulse. "The second stimulus falls at such a time that its impulse passes down the nerve in this reduced condition. On reaching the junctional tissue it cannot pass through, probably because that tissue conducts with a decrement. The reduced impulse has, however, passed along the nerve and left there a new state of impaired conduction; consequently the third impulse, if suitably timed, will also be propagated in a reduced condition and fail to pass the decrement. This state of things can be continued as long as the stimuli fall on the nerve with the appropriate frequency." But the author does not present this as "a satisfactory explanation of all forms of central inhibition."

The last chapter, on Central Inhibition, is mainly by Adrian and includes an interesting though somewhat hypothetical diagram of the mechanism of reciprocal innervation (Sherrington's "motor half-centers"). The central nervous system is pictured "as a net-

work of conductors having different refractory periods, communicating through regions of decrement, easily fatigued and capable of setting up a train of impulses in answer to a single stimulus." Throughout the volume prominence is given to the all-or-none law. Lucas believes "that nerve uses oxygen and gives off carbon-dioxide when it is conducting nervous impulses," and "that by its very nature the nervous impulse is dependent for its intensity only on the conditions which it encounters during conduction and not on the intensity with which it is initiated."

Another paper by Lucas (14) deals with summation in the claw mechanism of *Astacus*. In the adductor claw (nerve-muscle preparation) there is a local summation phenomenon which is due to the summation of two incomplete local excitatory processes, as is shown by the fact that this summation is not found when the two stimuli fall on separate parts of the nerve tissue. There is also a second type, the "summation of propagated disturbances," which takes place in a region of decrement and appears to be of the kind mentioned in the second preceding paragraph above. This summation probably takes place at the myo-neural junction, but Lucas makes the reservation that "it is not clear whether the arrival of the second impulse in the supernormal phase of the nerve would be a legitimate reason for its better conduction in the junctional tissue, since the course of recovery in the latter might be either quicker or slower than it is in the nerve." This statement puts the matter rather more tentatively than does the presentation in Lucas's book (13).

That the all-or-none law holds for normal muscle as well as for nerve seems now to have been definitely proved, by means of the ingenious "capillary electrode" invented by Pratt (15). One end of a glass tube is closed by fusing, and the fused end is allowed to elongate slightly under the influence of gravity. When cool it is very carefully ground away until the lumen of the tube just begins to appear on the ground surface of the end. Such a tube now makes an excellent liquid electrode in which the electrically active surface may be as small as 4μ in diameter, or even less. Since the single fibers of vertebrate muscle are considerably larger than this (20 to 50μ in the sartorius of frog), "it seems certain that a delicate adjustment of current will in the majority of instances cause an excitation of but one fiber, provided its surface be sufficiently near the pore."

Using this capillary electrode, both Pratt (15, 16) and Eisen-

berger (3) have been able to observe directly the isolated contraction of single muscle fibers. Eisenberger gives excellent photographs. Both authors show that the minimal contraction of a single muscle fiber follows the all-or-none law. If the fiber is fatigued by repeated stimulation at constant (minimal) intensity, the contraction does not gradually diminish. It remains at constant height, until (with sufficient fatigue) the series of contractions is suddenly broken off. And in general, "a continuous gradient of stimulation induces a discontinuous gradient of contraction in skeletal muscle."

Pratt (16) uses the term "*quantal*" to express both substantively and adjectively the conception of structural carriers [the muscle fiber] of such integers of energy in effects discontinuously graded. . . . A quantal, therefore, may be any all-or-none or, as Verworn has aptly termed it, *isobolic* system. A series of responsive values would be quantal when composed of discontinuous steps depending upon the additive discharge of successive quantals." The units in a muscle obey the all-or-none law, and the muscle as a whole obeys a quantal principle, although as a whole it notoriously appears to violate the all-or-none law. "Gradation of quick response is fibrillar; not fibrillar or sarcomeric. That is, the fiber as a whole forms the unit employed in effects of multiple constitution. It is to be assumed that in the response of a fiber all of the sarcostyles take part to the full dynamic capacity of each and every segment."

Another contribution of fundamental importance is a study by Forbes and Rappleye (5) of "the action currents of human muscles in voluntary contraction under as widely varying temperatures as possible and with as little variation as possible in the temperature of the central nervous system." . . . "The records showed with perfect uniformity a decrease in frequency together with an increase in amplitude of the excursions whenever the arm was chilled, and in most cases a somewhat less pronounced increase in frequency with a decrease in amplitude when the arm was heated." . . . "It seems to us to follow from the above results that the rhythm of action currents appearing in the electromyogram of human voluntary contraction is no direct index of the rhythm of central innervation involved in the act. The change of rhythm attending change of temperature would be inexplicable on any such basis. For why should a change in the temperature of the muscle cause a change in the frequency of discharge of impulses from the ganglion cells whose temperature remains constant? This might conceivably be

if afferent impulses coming from the chilled muscle so modified the nerve center as to alter its frequency of discharge; but this assumption is far-fetched and involves nervous influences to which we know of no analogy. . . . We agree, then, with Buchanan that the rhythm in the muscle does not follow the rhythm of motor nerve impulses, but depends rather on the condition of the muscle itself." Now Piper and Beritoff have shown that a frog's muscle can follow with separate action currents the rhythm of nerve impulses excited by induction shocks even up to the frequency of 250 or 300 per second: and in man the possible frequency of the muscle is probably higher. "We have here an apparent paradox; the muscle can respond separately to more than 300 nerve impulses per second, but when played on by the stream of impulses coming from the ganglion cells it responds with frequencies which may be evenly graded from 30 to 50 or more per second according to its own temperature." And the authors believe that the impulses coming from the ganglion cells have a frequency that is not less than 300 to 400, and may conceivably have an extreme frequency of 5,000 per second.

Now "it is not permissible to assume that any tissue has one 'specific rhythm' peculiar to itself. The rhythm or response obtainable from a tissue is a resultant of the curve of recovering excitability and the strength of stimuli employed. In the case of muscle excited through its nerve we have two refractory periods to consider, that of the muscle itself and that of the nerve, and also the lowered stimulating value of the impulse traversing the nerve during its relative refractory period. . . . Lucas has shown that in a fatigued nerve-muscle preparation the resistance to the passage of a propagated disturbance increases at the neuromuscular junction. The result of this in the case of voluntary contraction, maintained, as we contend, by subnormal nerve impulses of high frequency, would be to cut down still further the stimulating value of the impulses at the point where they act on the muscle fibers, and consequently to delay until nearer the end of their [the muscle fibers'] relative refractory period the time at which they would respond." In other words, after each stimulation of the muscle some of the next succeeding nerve impulses would reach the muscle during its more or less refractory period, and would so be lost: while a just later impulse would again stimulate the muscle. "Thus, without change in the nerve impulse frequency, the mere raising of resistance in the neuromuscular junction [as by cooling] would slow down the rhythm of muscular response." The discussion cannot be adequately

summarized here, and is well worth reading in the original. In agreement with Lucas, Pratt, and Eisenberger, the authors find themselves "forced to the view that in voluntary contraction gradation must be conditioned by gradation in the number of muscle fibers in action at a given moment, the doctrine of fractional activity, as Stiles has termed it."

An experiment of Gruber (6) on vasomotor changes in cats narcotized with urethane, seems to bear somewhat on the paper just reported. Electrical stimuli were given to the central end of cut saphenous, peroneal, ulnar, radial, median, and popliteal nerves, successively, and the vasomotor changes were observed on the carotid and on the femoral, artery. "With the same strength of stimulus pressor [vasoconstrictor] and depressor [vasodilator] results are obtained by varying the rate of stimulation from 1 to 20 stimuli per second." The more rapid rates of stimulation usually bring about vasoconstriction. While it may be that "summation" occurs with the more rapid stimulation, "it does not seem probable in this case where the strength is more than 400 times threshold that the phenomenon of summation can explain the different effects obtained with these rates of 1 per second and 20 per second interruptions."

Sherrington showed in 1892 that, in vertebrates, strychnine (which undoubtedly lowers the myo-neural resistance) abolishes the reciprocal inhibition of antagonistic muscles by converting inhibitions into excitations. Knowlton and Moore (8) now report a similar phenomenon in the earthworm. Normally a single excitation elicits "a shortening of the worm anterior to the point of stimulation and a lengthening posterior to that point." This "involves reciprocal innervation since a contraction of the circular muscles is associated with relaxation of the longitudinal ones." When treated with strychnine, the earthworm shows a shortening instead of lengthening of the portion posterior to the point stimulated. The posterior (as well as the anterior) muscles, both circular and longitudinal, now contract and "since the longitudinal muscles are the more powerful the net result is a shortening of the worm in a rigid condition."

Fletcher and Hopkins (4), in the Croonian Lecture of 1915, discuss the respiratory process in muscle. They contend that the muscle is a chemical, rather than a heat, engine. "The special processes which, when they occur within a muscle fiber, culminate in a contraction, make no call upon an oxygen supply; they proceed

anaërobically. The oxidations which are always associated with muscular activity are separated in time from that moment in which mechanical energy is liberated. They occur immediately afterwards, and are concerned not with the induction of the mechanical act, but with a restoration of the *status quo ante*." . . . "The work actually done, will bear variable and quite accidental relations to the heat production." The main reservoir of energy in a muscle is to be sought in its carbohydrate stores. "Placed in the right locality within the muscle, sugar, by a non-oxidative yield of acid at the right moment, and by a subsequent oxidation of this at another right moment, can yield its total energy in a manner exactly suited to serve the peculiar machinery in which, so to speak, it finds itself." Langley (11) has studied in the muscle of living animals the processes of loss of weight through atrophy, of fibrillation, and of regeneration and the recovery of muscular function after nerve suture, nerve section, and nerve insertion. Langley and Itagaki (9) have made determinations on the oxygen use of denervated muscles on one side of the body compared with that of undenervated muscles on the opposite side of the same animal (cat). "In all cases a much greater oxygen use per gram per minute was found to be present in the denervated muscles. We conclude from this that the atrophy of denervated muscle is not solely due to a decreased power of repair, the breakdown remaining constant, but that it must be due chiefly to an increase in the rate of breakdown of the muscle substance." This latter may be connected with the fibrillation of the muscle which begins soon after denervation.

Gruber (7) observes "that adrenalin does not lower the threshold of a normal, unfatigued muscle. . . . In the fatigued unaltered nerve muscle adrenalin may increase the height of muscular contraction by a twofold action, by improvement of the blood supply (vasodilation) and by its chemical action upon some substances in the muscle." Rogers, Coombs and Rahe (17) describe a special mode of preparing an extract, which they call a "residue," from endocrine glands. They find that "residues" from fresh thyroid, parathyroid, and adrenal (and from no other endocrine) glands are effective in reënergizing fatigued voluntary muscle (cat). The extracts were given by intravenous injection, and their point of action appears to be in or near the muscle fiber itself: the effects seem not to come *via* the nervous apparatus.

Adrian (1) has given a simple account, for clinicians, of Lapicque's two terms "rheobase" and "chronaxie." "If we take a

simple excitable structure, such as an isolated nerve-fiber or striated muscle fiber, and use as stimulus the simplest and most easily adjusted form of current, namely a galvanic current of known strength and known duration, we find that there are two limiting factors which determine the success or failure of the stimulus. These are (1) a certain minimal strength, and (2) a certain minimal duration. However strong it may be the current will not excite if its duration is shorter than a certain time, and its strength cannot be reduced below a certain level, however the duration may be prolonged. Within these limits the necessary strength and duration are related in the following way. For all durations which are long compared with the minimal duration the strength of current required to excite remains constant at its minimal value. As the minimal duration is approached the strength must be increased, and the increase becomes more and more rapid as the duration is reduced." For practical purposes the function "may be defined by two factors which Lapicque has called the rheobase and the chronaxie. The rheobase is equal to the strength of current required to excite when the duration is infinite, and we may consider it as depending on the absolute excitability of the tissue in question. The chronaxie depends on the rapidity of the excitation process, and it is equal to the duration at which the current must be increased to twice its minimal strength," *i. e.*, to twice the rheobase. "The rheobase is of little practical importance as an index of the condition of the tissue, for it is impossible to compare it in different cases with any profit unless the conditions of stimulation are very accurately controlled as to resistance, current flow per unit area, etc. On the other hand the chronaxie can be measured without any of these precautions, since we need only determine the duration at which the current strength must be twice the threshold value, and the disposition of electrodes, resistances, etc., does not matter. It is found to be remarkably constant for similar tissues examined under similar conditions of temperature, perfusing fluid, etc. Further, it shows very great variations in different types of tissue. . . . In the chronaxie we have a constant which is definitely related to the state of the excitatory mechanism of the tissue."

In a study of cutaneous sensation after nerve-division Boring (2) includes a valuable discussion of Head's attempted division of cutaneous sensibility into "protopathic" and "epicritic" systems. For reasons which seem to the reviewer good, Boring does not accept Head's hypothesis.

Lashley (12) has studied the accuracy of voluntary movement in a young man who, "as a result of gun-shot injury to the spinal cord," has a partial anæsthesia of both legs with motor paralysis of the muscles below the knees. It was not possible to learn "the exact extent of the lesion, . . . but the clinical picture indicates an extensive destruction of the dorsal bundles in the second or third lumbar segment of the cord with invasion of the dorsal horns or injury to the afferent roots in the sacral region sufficient to abolish the tendon reflexes." The degree of anæsthesia of the patient was determined from his introspective judgments when his leg was placed in various positions or moved through various angles by the experimenter. When seated, the patient could not voluntarily maintain any other position than that of hyperextension of the knee, and this for but a short time. "There was momentary maintenance of position, relaxation without recognition of the movement, and later an illusion of relaxation." The patient would often not know (in passive movements) in which direction, to say nothing of the distance, his lower leg was moved. The author believes that the anæsthesia of the leg was "sufficiently extensive to exclude any reflex control of the accuracy of movement based upon cortical excitations arising from the moving limb." Nevertheless the patient could move his lower leg in either direction as designated, and could so far control the (verbally designated) distance of his movement as at least to move farther when the distance suggested was longer, and *vice versa*. He generally moved too far. And he could reproduce a voluntary movement of his own with an accuracy that compares very fairly with that of a normal subject. The author believes that the extent of movement was not determined merely "by the control of the duration of the excitation of motor pathways."

Langley and Hashimoto (10) have an interesting paper on the course of nerve bundles in the nerve trunk. It appears that nerve plexuses are frequent between the elements combined in a nerve trunk—plexuses of fibers in small nerves, of bundles in larger nerves. Such plexuses are found especially in the vicinity of the points where nerve branchings are given off. "The complexity of the lower plexuses in the sciatic of the larger mammals makes it, we think, certain that, so far as dissection goes, no bundle above the plexus can be said to correspond even approximately with any bundle below it." The time taken for recovery of function after nerve-division is not altogether the time taken by the regeneration of the

nerve-fibers: there is a further time required for the reëducation of nerve connections, especially central ones.

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TROPISMS AND INSTINCTIVE ACTIVITIES

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Chemotropism and Feeding Reactions.—Kepner and Edwards (13) find that the *amoeba Pelomyxa* has two types of feeding reactions, one to non-moving objects, which have "no possibility of escape"; the other to objects in motion, which may escape. The latter type is much more varied and adapted to the position of the object than the former, and no existing theory of the movements of *Amoeba* will explain it. Instead of writing merely of moving or resting stimuli, the authors seem to prefer calling them objects which may or may not escape, and almost imply a kind of foresight on the amoeba's part.

Shadall (36) reports that *Opalina*, when in an alkaline medium, reacts positively to acids: it may cease to react to chemicals after repeated stimulation.

Schaeffer (35) continues his very important observations on *Amoeba*. He finds that it can choose between digestible and indigestible particles. If the two kinds are stuck together, the food cup separates them. The movement of a particle is, however, the most important condition of the feeding reaction. Glass particles are eaten if they are in motion. The basis of discriminations in all the feeding reactions Schaeffer thinks is physical rather than chemical. He is on debatable ground when he conjectures that a true chemical sense does not exist anywhere, arguing that such a sense ought to inform us of the chemical constitution of bodies: one might as well urge that a true light sense does not exist because we do not see white light as complex.

Wulzen (45) observed that as soon as a hungry planarian came into diffused meat juice, it protruded and waved about its pharynx, then withdrew it and proceeded in the direction of the food. This would seem to be an interesting example of the anticipation of a consummatory reaction, of which Craig (7) speaks. If the planarian is sectioned behind the cephalic lobes and in front of the pharynx, an inhibitory influence is apparently lost and the pharynx remains extended in the meat juice, which is ingested. Some interesting observations were made on the isolated pharynx, which was

found to respond to meat juice when entirely separated from the body.

Light Reactions.—Frog tadpoles are found by Cole and Dean (5) to be sensitive to light when 40 mm. long. The skin is the most important receptor, and the tail the most sensitive region. The youngest larvæ are indifferent to light; later a photokinetic stage is reached, and the final stage is one of positive response. The mechanism is probably nervous and does not involve the melanophores.

Patten (25) has studied the reactions of the whip-tail scorpion by measuring the angular deflections from the original direction of locomotion. Both a kinetic and a directive effect of light were found, produced both by change of intensity and by constant intensity. Orientation seemed very definite.

Reese (32) reports that the crimson spotted newt collects in darkened regions in moderate temperatures, orients positively to light of all intensities, but inhibits or reverses this behavior at low temperatures. Red light produces the same effect as white, but in a less degree; green still less, and blue least.

The problem of the relative stimulating effect of different colors to organisms was investigated by Mast (17) for the following: *Euglena* (five species), *Phacus*, *Trachelomonas*, *Gonium*, *Pandorina*, *Eudorina*, *Spondylomorom*, *Arenicola* larvæ, earthworms, and blowfly larvæ. For all these certain colors were more efficient than others, but in every case a suitable change of intensity would obliterate the difference, so that no evidence of color discrimination appeared. The distribution of efficiency in the spectrum has no correspondence with the degree of species relationship: near relatives differed markedly. It is also independent of physiological state, environment, and the positive or negative character of the response. Against the contention that animals and plants are essentially alike in their responses to light, it is shown that the shorter wave lengths are relatively more efficient for green plants than for any animals.

In favor of Loeb's views Garrey (9) reports observations on the robber fly, like those made some years ago by Holmes on *Ranatra*, with a different conclusion. Blackening one eye, illuminating one eye, blackening or illuminating halves of the eyes, produced in each case circus movements which were in perfect accord with Loeb's tropism theory. When one eye was kept in darkness for two or three days, the fly circled to the side from which the black had been removed: this is held to be purely an effect of darkness adap-

tation. Loeb and Northrup (14) report that on *Balanus* larvæ the effectiveness of a light intermitted by having a sector of 90 degrees cut out of a rotating disk was to that of an equal light of constant intensity as one to four, thus corresponding to the Bunsen-Roscoe Law. On the other hand Dolley (8) urges against Loeb's continuous action theory that Vanessa does not move faster in strong light than in weak, but the reverse; it moves faster in intermittent light of a certain frequency than in continuous light. Its orientation is, he holds, due to the rate of change in intensity.

Goldsmith's (11) studies of the reactions of a cephalopod to colors are wholly devoid of any precautions against sources of error. Polimanti (28) has studied the effect of different colored lights on the respiration rates of an octopus and of fish; the method, it will be remembered, of Babak. In the case of the octopus, the number of respirations increased on passing from white to colored light: violet and blue were most effective and red least. On the fish, red produced greatest increase of respiratory rate: this Polimanti explains ingeniously by the fact that in their normal habitat such rays reach them only to a very slight degree. The colored lights were produced by solutions in the water where the animals were: it would seem to the reviewer that the chemical effect of these solutions might be a source of error.

Schaeffer (34) reports the curious observation that *Amœba* apparently senses a beam of either light or darkness before entering it; in fact, from a distance of 100 to 150 microns. He has no explanation to suggest.

Geotropism and Rheotropism.—Cole (4) finds that *Drosophila*, when creeping, is negative in its response to gravity, centrifugal force, and air currents, the stimuli being probably received by the leg muscles. Parker (24) in a study of the behavior of *Corymorpha*, reports the hydroid negatively geotropic, the response, as evidenced by the fact that it can be abolished by chloretone, (22) being of neuromuscular origin. The main object of the paper is to describe the neuromuscular system, which he reports as more like a reduced actinian system than a primitive one, the stalk, proboscis, and tentacles each having a mechanism. Olmsted (21) says that the geotropism of *Planaria maculata* depends on previous exposure to light and on the state of hunger or satiety. Turner (39) describes the positively geotropic movements of *Euglena* in quince jelly: in thin jelly the flagellum is used; in thick jelly the movement is of a different type, which is effective only on a solid support.

The fish *Epinephelus striatus* is said by Jordan (12) to show a negative rheotropism instead of the common positive or head to current response. The stimulus is apparently received by the lips.

Color Changes and Melanophore Reactions.—In certain crabs (Brachyura), Longley (15) reports that temperature is much less effective than background color in producing color changes.

Redfield (31) has two interesting papers on the melanophore reactions in the horned toad. These reactions are of three types: (1) a daily rhythm, darkening in morning and afternoon, lightening at midday and night (this is a local effect, occurring in skin isolated from the nervous system; it is affected by the temperature); (2) changes adapted to the substratum, involving the eyes and not occurring when the animal is blindfolded; (3) a contraction of the melanophores under nervous excitement. This last effect results from a hormone, probably adrenin, produced under nervous excitement: the melanophores are also under the direct control of the nervous system, so that there seems a high degree of resemblance between the physiological bases of emotion in reptiles and in mammals.

Rhythms and Periodic Activities.—The color rhythm in the horned toad just mentioned may be noted under this head.

Parker (23) says that the sea-anemone *Sagartia luciae* has a tidal rhythm of expansion and contraction: Metridium a daily rhythm. Neither of these rhythms however shows any anticipation or persistence after the stimulus is withdrawn, as certain French observers have reported. Strong light and high temperature cause retraction, food and water currents cause expansion.

Redfield (32) has observed that the rhythmic contractions of the mantle in lamellibranchs increase in rate during the early stages of suffocation, and that if they are checked the clams suffocate.

A rhythmic heat period, marked by a flow of secretion every sixteen days, is reported as occurring in the guinea-pig by Stockard and Papanicolaou (38).

Baldwin (3) took observations of the activities of the earthworm at twenty minute intervals for a period of one month. The total time of activity was about one third of the time: there were definite periods of activity, which fell especially in the early night hours.

Murphy reports to *Science* (20) a pleasing tale of a bat which he saw going in swimming in the open space of a park pond with the temperature at thirty Fahrenheit.

There has been continued discussion of rhythmic concerted activities on the part of animals. Wheeler (43), for example, describes rhythmic simultaneous up and down movements of Phalangidæ on their long sensitive legs. The stimulus seems to be air currents, and is propagated by the contact of the legs of the insects. Peairs (26) tells of how at intervals of from three to five minutes a few web-worm larvae will start a rhythmic swinging of the front of the body held erect, the movement being taken up by the others, so that for fifty seconds or so all are moving at the rate of about forty swings to a minute. Allard (1) thinks the synchronous rhythm in the chirping of crickets is due to their hearing each other. Gates (10) on the other hand says that complete synchronism in the flashing of several fireflies is a rare accident, and that a fly cannot be made to change its rhythm by flashing an electric torch. Craig (6) is very skeptical regarding the imitation of a rhythm in one animal by another. He calls attention to the danger of subjective rhythm on the observer's part, and maintains that mechanical transmission of rhythm through the substratum will explain practically all cases of collective rhythms.

Miscellaneous Instincts.—Wells (42) makes a contribution to our knowledge of the homing of limpets by showing that their path is commonly an oval, so that they do not retrace their outward course.

McCulloch and Yuasa (16) say that the direction of migration of Hessian fly larvæ is wholly predetermined by the orientation of the eggs; the larvæ always turn from the anterior to the posterior end of the eggs.

Rabaud (29) finds that the paralysis of spiders by wasps is not due to the wounding of nerve centers, but to the rapid diffusion of the poison.

Utsurikawa (40), comparing inbred with outbred rats, finds the latter more active, less savage, less responsive to auditory stimuli, more restless under continuous stimulation but less so under momentary stimulation, more sexually different.

Craig (7), whose patient and original observations on animals will result, the reviewer believes, in conclusions of the utmost importance, makes some suggestive remarks on the general nature of instinct. He defines an appetite as agitation continuing in the absence of a stimulus, often beginning with an incipient consummatory reaction; an aversion is defined as agitation continuing in

presence of a stimulus. The typical cycle is (1) absence of the stimulus (appetite), (2) reception of the stimulus, (3) surfeit (aversion), (4) freedom from the stimulus, rest. Some instinctive appetites are so persistent that if they do not get the normal stimulus they make connection with an abnormal one, to which the consummatory reaction is given.

The reader who wishes to relax his mind from the scientific rigor of the foregoing summary may do so by contemplating the theory of Hiram Maxim (18) that cases of mimicry or protective resemblance among animals are due to the mimicking animal's perceiving by telepathy the mental processes of its enemies.

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SENSORY PHYSIOLOGY OF ANIMALS

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There has been this year a slight falling off in the proportion of studies devoted to the sensory physiology of vertebrates. Only one paper (6) reports any attempt to measure differential sensitivity and in only one is the discrimination method employed (36). This field has been chiefly the domain of psychologists and its present barrenness is doubtless the result of the diversion of their interest to military problems. Several studies inspired by interest in animal ecology seem to promise the development of an applied science of animal behavior.

General Studies.—Olmsted (18) records the responses of an holothurian to pressure, gravity, light, heat, and chemicals. Hecht (13) studied the tactile, thermal, and chemical sensitivity of an ascidian. The studies are limited to detection of sensitivity and determination of the reflex responses.

Tactile Sensitivity.—The tactile sensitivity of a scale-covered fish, the hamlet, was examined by Crozier (9). Visual responses usually predominate in the behavior of this fish, but when vision is destroyed in any way it shows extreme sensitivity to slight currents in the water, reacting to wires or slender rods moving slowly at a distance of five centimeters. Cocainization or transection of the spinal cord destroys this sensitivity but leaves some chemical sensitivity.

Parker and Van Heusen (31) eliminated successively the sensitivity of the lateral line organs, ear, and skin of the catfish. All these organs were found to be sensitive to slow oscillations of the

surrounding medium. All are sensitive to sound, the upper thresholds being; skin, 172 dv.; lateral line, 344 dv.; ear, 688 dv.

Sherrington (38) describes a variety of reflexes which may be elicited by stimulation of the pinna of the cat. Their thresholds for mechanical stimulation are low, for electrical very high. They can not be classified as the result of deformation of the surface, but are due to "affective touch."

Sensitivity to Chemicals.—Crozier (6) compared the time required by earthworms to withdraw the posterior half of their bodies from solutions of sodium hydroxide and ammonium hydroxide of different concentrations. The intensity of reaction of the worms was found to be directly proportional to the concentration of the alkalis. Ammonium hydroxide is the less effective stimulating agent. From the relative efficiency of the two alkalis in penetrating cell membranes and in ordinary chemical reactions it is argued that the process of stimulation must be dependent upon a chemical reaction at the surface of the cell and not upon penetration of the cell. The author used a similar technique in a study of reactions to acids (7) and concludes that they too stimulate primarily by a surface action.

Copeland (5) found that the entire skin of marine snails is sensitive to concentrated meat-juices. Very dilute solutions stimulate only the osphradium which is so located that the water drawn in through the siphon passes across it. As the siphon is moved about it draws in solutions of varying concentration and the snails orient in the direction of the stronger stimulus. Hamilton (12) records the reactions of moist-soil dwelling insects to gradient of evaporation, temperature, carbon dioxide, and ammonia. Reactions were obtained in all these gradients but the sense organs involved and the mechanism of orientation were not determined. Weese describes the reactions of the horned lizard to gradients of air humidity, air temperature, and substratum temperature. The animals avoid air of high evaporating power, select an air temperature between 35 and 40 degrees. Chenoweth (2) tested the sensitivity of the white-footed mouse to gradients of evaporating power of air. The mice chose the moister end of the cage most frequently. No indication of the sensory mechanism involved is given. These three studies were directed primarily to determine the form of stimulation which leads to the selection of habitat. In each case the animals were found to select an optimum of temperature and moisture corresponding to their normal habitat.

Static and Auditory Sensitivity.—Lyon (25) chilled *Paramecia* until they no longer reacted to gravity, then centrifuged them and found that the anterior ends are heavier. This answers the criticism that his earlier results may have been due to active orientation by the animals. Kanda (20) also finds the anterior end of *Paramecium* the heavier. In the centrifuge granules are thrown into the anterior end of the animals, along with the nuclei. Geotropism reappears when the nuclei and granules regain their original positions. Data are presented to show that apparent reversal of the direction of orientation to gravity as a result of changes in temperature or chemical composition of the medium is due to the mechanical shock of transfer or to reduction in the activity of the animals.

Parker (29, 30) finds that the hydroid, *Corymorpha*, orients to gravity by what appears to be a true neuro-muscular reaction. Olmsted (27) gives evidence for geotropic responses in planaria. These vary with the degree of hunger and of exposure to light.

Turner (39) describes some experiments which indicate the lack of any specific reactions to gravity in caterpillars. Fruit flies, walking, orient negatively to gravity. Cole (3) sought to discover if gravity acts as a stimulation to activity as well as to orientation. Tests with stationary tubes involve mechanical stimulation when the flies are put under the experimental conditions. To avoid this and so test the kinetic effects of gravity Cole centrifuged the flies and found that they reacted negatively to the centrifugal force, from which he concludes that gravity alone can act as a stimulus to activity. No mention is made of measures to prevent vibration of the centrifuge.

Johnson (18) describes the structure and development of the lateral line organs of selachians and gives a brief review of the literature of this field.

Hussey (17) reports observations on the reinforcing effects of auditory and visual stimuli upon birds in the field.

Parker and Van Heusen (31) ascribe auditory function to the skin, lateral line organs, and ears of the catfish.

Hunter (16) has devised a technique for study of audition in the rat by interference of stimuli. He presents data bearing upon problems of habit-formation and promises the results bearing upon audition in a later paper.

Sensitivity to Light.—Laurens and Hooker (23) describe apparatus for producing a series of spectral lights of equal energy. They

use a constant-deviation spectrometer and their method of calibration does not differ essentially from that of earlier workers.

The eye of the flat-worm, *Prorhynchus*, consists of a single retinal cell and an accessory pigment cell. Kepner and Foshee (21) find that the pigment cell expands in darkness and contracts in light. The retinula shows three regions resembling the divisions of the vertebrate retinal cell. In light the rhabdome is rounded, the refractive segment is large (at an optimum illumination), and the nuclear part of the cell is narrowed. In darkness the rhabdome becomes flattened and the nuclear part of the cell grows wider. The functional changes, therefore, do not correspond to those shown by the vertebrate retinulae. Laurens and Williams (24) compared the photochemical changes in the normal eyes of *Amblystoma* larvae with those occurring in transplanted eyes having no connection with the central nervous system. Changes in distribution of pigment and length of cone myoids in alteration from light to darkness adaptation were found to be greater in transplanted eyes than in normal ones. This seems to agree with Arey's suggestion of the existence of inhibiting fibers in the oculomotor nerve.

Laurens (22) finds that in both normal and eyeless *Amblystoma* larvae the melanophores contract in darkness and expand in light. These conditions are permanent in eyeless individuals, but normal animals after three or more days exposure to light or darkness show a "secondary reaction" which produces a nearly complete reversal of the first condition. This response is mediated through the eyes and is apparently an adaptation to the background. According to Bray (1) the melanophores of the catfish contract in light and expand in darkness. But if the fish are badly frightened they may remain light in color even after days in darkness. Adrenalin is found to produce contraction and Bray suggests that the contraction of melanophores in frightened fish may be due to the action of a hormone. Redfield (34) finds that the melanophores of the horned lizard react to light, temperature, color of the substratum, and exciting stimuli. The latter is probably the result of adrenalin production.

Dolley (10) gives an extensive account of the reactions of *Vanessa* to light. Circus movements appear when one eye of the insects is rendered nonfunctional but the deflection from the straight course is not proportional to the intensity of the light. In very low intensity of light there is a reversal of the direction of circus movements. These, with other facts, indicate that the response is to

change of intensity and not to the continuous action of the light. In a later study (11) he measured the rate of locomotion in Vanessa toward lights of different intensity and found that they move more rapidly in response to dim light than to direct sunlight. They also move more rapidly in response to a beam of light interrupted 10 to 16 times per second than to a continuous light of the same intensity. This is in contradiction to Loeb's theory of the continuous action of light in orientation. Holmes (15) verifies his observations of the effects of continuous action of light in the orientation of Vanessa, with more careful controls.

In a preliminary study Patten (32) describes the reactions of the whip-tail scorpion to light. The animals are regularly negative in their responses to all intensities between 120 and 0.16 m.c. They give no evidence of reaction to visual objects. When the median or lateral eye-groups of one side are blinded circus movements result. McEwen (26) finds that when the wings of the fruit fly are cut off the reactions of the insects to light almost disappear and the loss of phototropism is proportional to the amount of wing destroyed. A number of hereditary strains of partly wingless flies are available and in them also the responses to light are proportional to the degree of defect of the wings. There are probably no light receptors in the wings; the phenomenon seems to be one of sensory reinforcement. A strain of flies has been found in which a lack of phototropism is associated with tan body pigment and is inherited as a Mendelian recessive. The various eye-color mutants do not have identical sensitivity to different wave lengths of light. For the dark eyed flies red light has relatively greater stimulating value.

Crozier (8) states that Balanoglossids orient negatively to light. The proboscis is most sensitive. Light production by the animals is inhibited by exposure to light.

Van Heusen (40) finds that catfishes from which the eyes have been removed retain sensitivity to light. The skin of the hamlet is also found photosensitive by Jordan (19). The time required for stimulation is inversely proportional to the intensity of the light.

Cole and Dean (4) find that the tadpoles of *Rana clamitans*, 40 or more centimeters in length, show greater activity in light than in darkness. Some large specimens were positive to light. Reese (35) reports experiments to show that the spotted salamander is negatively phototropic, losing the reaction at high and low temperatures. While they gather in shaded parts of the aquarium they tend to go directly toward the source of light.

Pearce (33) trained rats to react to light versus darkness, using a method similar to that of Hunter for sound. The visual response is learned more rapidly than the auditory. Similar results have been obtained in studies of the conditioned reflex, but no suggestion has yet been made to account for the greater difficulty in associating a reaction with one rather than another form of stimulation.

Rochon-Duvigneaud (37) gives a summary of the relative number and size of the rods and cones in various reptiles and birds and discusses briefly their function in day and night vision.

Reeves (36) shows that the rat may learn to distinguish between stationary and moving lights and that they have an instinctive tendency to go toward the moving light. This accords with the general concept that a moving stimulus has greater efficiency than a stationary one.

In a lecture before the Morphological Society of Munich Hess (14) summarizes the results of experiments upon the light reactions of a number of animals. In the alcoipid he finds a new method of visual adaptation to distance. Fluid is forced into the vitreous sac from an adjacent bulb. Hess has continued his studies of color-vision by the method of pupillary response and the contractions of the pupils of normal and color blind men in different wave-lengths of light were measured for comparison with results obtained on animals.

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SPECIAL REVIEW

The Animal Mind. A Text-book of Comparative Psychology.
MARGARET FLOY WASHBURN. 2d Edition. New York: Macmillan, 1917. Pp. xii + 386.

The second edition of this text represents considerable revision. The obvious changes consist for the most part of, *a*, the inclusion of the later experimental data to bring the book up to date, *b*, the omission or curtailment of some of the older material in the interests of space, *c*, the amplification of certain positions and doctrines where greater clearness was demanded, and, *d*, a reorganization of the mode of presenting and treating certain topics. There has been no change in point of view, or in the general plan of the text.

The topical organization of chapters 1, 2, 4, 6, and 13 of the older text has not been latered. The topics concerning the paramecium and tropisms have been omitted in chapter 3. A new section on the chemical sense of Protozoa has been added in chapter 5. Chapter 7 on vision has been pretty thoroughly reorganized, more space being devoted to its consideration than formerly. Chapters 8 and 9 devoted to spatial reactions have been altered. The topical outline for orientation to gravity is the same as formerly, while the treatment of orientation to light has been revised. The homing reaction of animals has been included as one of the evidences of image vision. The most pronounced alteration concerns chapters 10, 11, and 12. These were condensed into two chapters and the material is presented in a different manner. On the whole the revised organization represents a distinct improvement in clarity of presentation.

The doctrine that subjectivism constitutes the proper goal of comparative psychology has been re-affirmed with considerable emphasis. "There exists an inner aspect to behavior, the realm of sensations, feelings, and thoughts, which is not itself identical with behavior or with any form of movement. . . . Our object in this book will always be the interpretation of the inner aspect of the behavior of animals; we shall be interested in what animals do only as it throws light upon what they feel. To the true psychologist, no challenge is so enticing as that presented by the problem of how it feels to be another person or another animal; and although we

must sometimes give up the problem in despair yet we have also our successes. We have wonderfully advanced, within the last twenty-five years, in knowledge as to how the world looks from the point of view of our brother animals." This plan has been followed rather consistently for the most part, but here and there, I suspect, a critical and unsympathetic reader may find statements of fact and descriptions of behavior which are not utilized in any obvious fashion in interpreting the inner life of animals. Section 80 is devoted to a consideration of the relation of age, sex, individual differences, and distribution of effort to the learning process, but the significance of these facts for inner experience is not discussed.

The chapter on the Evidence of Mind has been introduced by a new paragraph. "In this chapter we shall try to show that there exists no evidence for denying mind to any animals, if we do not deny it to all; in other words, that there is no such thing as an objective proof of the presence of mind, whose absence may be regarded as proof of the absence of mind." Such a statement may raise the question in the minds of some readers whether the author believes in the existence of an animal mind and as to what are the grounds of her belief. Later we are told that we know beyond a reasonable doubt that mind exists in those animals of a structure resembling ours which rapidly adapt themselves to the lessons of experience. The structure of all animals resembles ours to some extent; it is a matter of the degree of resemblance. How similar the resemblance and how rapid the adaptation are questions which are not discussed.

The treatment of the learning process has been considerably modified. The data are discussed under four headings,—the dropping out of movements, the formation of a series of movements, the recognition of landmarks, and learning involving the anticipation of movements. The second topic is new. Movements tend to be abandoned when they mediate consequences of no importance to the organism. The illustrations cited are those of adaptation. Movements with harmful consequences are eliminated because of the initiation of more prepotent tendencies, and useless acts are dropped because of the survival of successful responses. Ideas are involved when movements are anticipated. Cole's experiments do not prove the existence of ideas. But three types of experiment demonstrate the presence of ideas. The multiple choice method is efficacious only when the animal succeeds in choosing the *middle* door of a series. The second is the delayed reaction test. Ideas

are necessary in inferential imitation, and this type of response has been demonstrated for the monkey by Kinnaman and Haggerty.

The adoption of the subjective position will meet approval in some quarters and dissent in others. Such a division of opinion is not subject to argument. Ultimate values are rarely susceptible to profitable discussion. Those who are interested in the nature of the inner experience of animals as an end in itself are not likely to be dissuaded from their purpose by the arguments of the behaviorists, and to a behaviorist the continual quest for the psychic necessarily constitutes a futile, distracting and useless undertaking.

Opinions will differ as to the value of the book as a text. Naturally the behaviorists will find some difficulty in adapting the book to their needs. Others will possibly maintain that too much space has been devoted to sensation at the expense of the learning process. Some of the reviewer's students have complained of becoming lost and confused in the mass of detail in certain of the chapters on sensation and space. However, no text will meet with universal favor.

Practically all students of animal behavior are agreed as to the worth of the book for purposes of reference. Good judgment has been exercised in the selection of material. The material has been carefully digested, well organized, critically evaluated and for the most part clearly presented. The book represents the most exhaustive and complete summary of the experimental literature now extant. For the serious student of comparative psychology the book has proved to be invaluable.

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THE PSYCHOLOGICAL BULLETIN

TUNABLE BARS, AND SOME DEMONSTRATIONS WITH A SIMPLE BAR AND A STETHOSCOPE.¹

BY PAUL THOMAS YOUNG

On Mounting and Striking a Bar.—The fundamental nodes of a transversely-vibrating bar,² which is free at both ends, are located .22416 of the total length of the bar (or approximately two-ninths of the total length) from each end (Fig. 1). The location of these



FIG. 1. Location of nodes of a transversely vibrating bar, *N*.

nodes may be determined empirically by sprinkling sand or sawdust upon the vibrating bar. The material quickly forms a narrow line perpendicular to the main axis. That the vibratory motion is minimum at these lines and maximum at the center and ends may be readily felt by running the finger gently along the vibrating bar.

After the location of the nodes has been determined the bar should be supported upon tightly-stretched string³ (fish cord is good) directly at the fundamental nodes.

The bar should be struck lightly with a piano hammer or tapped with the finger. If the blow is heavy, high enharmonic partials

¹ From the Psychological Laboratory, Cornell University.

² Bars for experimental purposes should be made of brass or steel.

³ Bars are sometimes supported at the nodes upon triangular strips of cork, pieces of felt, or cotton rope. For laboratory uses it is better to rest the bar upon strings tightly stretched across some sort of a frame.

will be heard; but the partials quickly become inaudible and only the pure tone remains.

The tone of a bar supported in mid-air is quite faint. However, if a stethoscope⁴ be used, the tone will be heard clearly and distinctly. It is of uniform intensity and long duration. With a moderate blow the tone may be heard for 120 secs. or more.

On Tuning.—The frequency of a bar varies inversely as the square of the length and directly as the thickness. Hence, to sharp a bar the ends should be cut or filed. To flat a bar the thickness should be reduced. In practice, however, the bar may be more easily flatted by sawing or gauging the central portion at right angles to the principal axis. Such cutting increases the elasticity of the bar which decreases the frequency.

Forks and Bars.—The practice of tuning bars is thus very similar to that of tuning forks. Cutting the ends for sharpening corresponds to filing off the tines. Gauging or filing the center for flatting corresponds to filing between the tines.

The bar, in fact, *is* a fork straightened out; or (which is the same thing) the fork is a bar bent into the shape of a *U*. If we gradually bend a bar into a *U*, the two nodes approach the base. When the bending is complete we have a single node at the base—*i. e.*, a fork.

Because of this physical similarity between bars and forks mechanical devices now in use with forks can, with slight modification, be applied to bars. The mechanical hammers, for example, designed to deliver a constant blow to a fork, may be used equally well upon a bar. Also it is possible to maintain a bar electromagnetically upon the principles now in use with electric forks.

TUNABLE BARS FOR PITCH DISCRIMINATION.

Tunable Bars versus Tunable Forks.—The tunable bar as an apparatus for laboratory work has two principal advantages over the tunable fork.

In the first place, a single load is used on the bar which takes the place of two loads used on the fork. A single adjustment is easier and more accurate than two. With the fork a single load could not

⁴ By procuring ear-pieces a simple and satisfactory stethoscope can be made from a Y-tube, some rubber tubing, and a bit of wire. The wire should be passed through the Y-tube and into the rubber tubes connecting with the ear-pieces. It thus acts as a spring to hold the ear-pieces in place. We are indebted for this suggestion to Dr. G. J. Rich.

For work with bars the straight-cut end of a rubber or glass tube is satisfactory. No funnel or cup is necessary.

be used, since it would displace the node, thus disturbing the purity and sustaining power of the tone. Also an unequal balance of the two loads relative to the fundamental node at the base would tend to produce the same result. With bars every change of the load shifts the nodes slightly, but the tonal purity and sustaining power are not affected since the nodes are free to move. The displacement of the nodes by a few mm. corresponding to shifts of the tuning load may be demonstrated by sprinkling sand or sawdust on the bar.

In the second place, the tunable bar is free from variations of timbre and intensity due to the use of sounding-boxes. While a resonance chamber responds more or less to a whole tonal range its maximum efficiency corresponds to a single point on the tonal scale. Theoretically the resonator of a tunable fork should be changed with every tuning, in order to avoid damping and timbre changes and to insure uniform resonance for the different adjustments. It was the presence of timbre differences in a set of tunable forks at the Cornell Laboratory that led the writer to experiment on tunable bars as a possible substitute.

The bar is supported in mid-air upon strings so that the only direct contact with a resonating body is through the strings. Since the vibratory motion at the points of support is zero, no energy is lost at the supports and the resonance error is eliminated. Of course, a fork may be hung from a string or held in the hand so that the resonance error is practically eliminated. But to be permanently mounted a fork must be clamped at the base which (even with padding) does not remove the possibility of resonance errors. A bar, however, can be permanently and conveniently mounted so that it is free from resonance. The use of a stethoscope insures a loud and distinct tone which with a fork is gained by a resonator.⁵

⁵ A number of tests were made upon the duration of the tone with and without a resonator, and the duration of the tone with resonator tuned and mistuned. A tunable bar of the dimensions $.6 \times 3.5 \times 25.0$ cm. was tuned to A 435 vd. A copper tube 5 cm. in diameter resting in a jar of water served as a resonator. When in tune for A 435 vd. the resonance length was 16.4 cm. For a mistuned resonator the bar was tuned with the rider to 415 vd. while the perfect resonance for 435 vd. was unchanged.

There was no exact control over the intensity of blow. We endeavored to deliver a uniform "heavy" blow and a uniform "light" blow. The differences in duration, as measured with a stop-watch from the time of impact to the time that the tone became "just inaudible," are so gross that it was not necessary to resort to a more delicate control over the energy of impact.

The following table shows a few typical results:

These two advantages, however, introduce corresponding disadvantages. The use of one rider instead of two reduces the tuning range that is obtainable. To increase the load beyond a certain point necessitates a compensatory adjustment of the supporting strings with every tuning. The increased load does give an increased tuning range, but it makes the calibration of a delicate scale impossible. However, for nearly all uses a sufficient tuning range can be obtained with a single rider.

Another disadvantage is the use of the stethoscope. For mental testing a stethoscope is 'unnatural' and therefore not desirable, since it may distract a subject unaccustomed to laboratory procedure. Although it is possible to use the bar without a stethoscope the tone is quite faint.⁶

Two Forms of the Tunable Bar.—While any device for changing the moment of inertia relative to the node will vary the frequency of a bar, the two following forms have proved to be the most satisfactory.

I. For continuous tuning the load is adjustable in a slot from the node to the end of the bar. This load is made of two pieces of brass or steel (Fig. 2, *a*, *a'*) so cut that they slide easily, but with little rotary motion, in the slot. These two pieces are clamped firmly to the bar at any point in the slot by means of a bolt (*b*) and a set-nut (*c*). The upper piece has a hair-line (*d*) which is used in

Resonator in Tune for A 435 Vd. and Therefore Mistuned for 415 Vd.			No Resonator Used	
Bar Tuned to	435 Vd.	415 Vd.	435 Vd.	415 Vd.
Duration of tone in secs. with a "heavy blow".....	13 10	50 53	132 126	114 131
"light blow".....	6 6	27 36	76 80	65 80

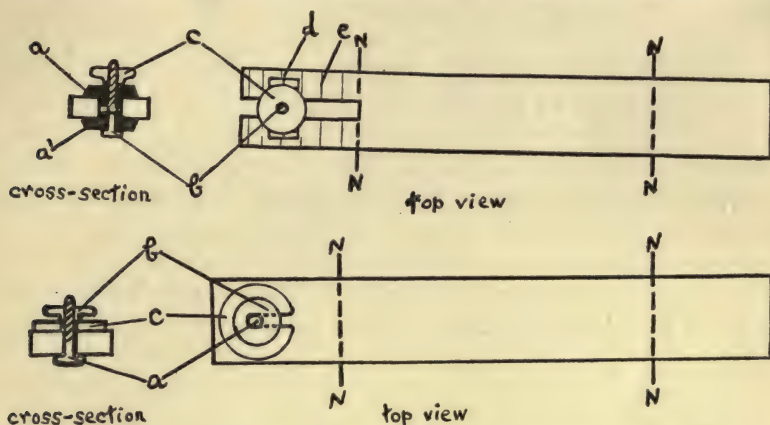
The figures tell their own story in unmistakable terms. A resonator increases the intensity but thereby absorbs the energy of vibration. A mistuned resonator gives partial resonance and consequently the duration of tone is longer than with perfect resonance and shorter than with no resonance. The longest durations of tone were obtained with no resonator.

Mistuned resonators introduced loud partial tones which interfered with the judgments of pitch difference.

⁶ Of course the bar may be mounted upon a resonance box by gluing triangular strips of cork to the box so that they support the nodes. A bar thus mounted (and if necessary held in place by rubber-covered pegs) is about the same as a tunable fork mounted on a resonance box.

setting the rider to any desired point of the scale (e). The scale is marked upon the surface of the bar.

To determine the mass of a load that will give a tuning range of N vibrations the bar should be tuned to the higher of the frequencies desired and then gradually loaded at the end until the lower fre-



FIGS. 2 and 3. Two forms of tunable bar. Fig. 2 is the continuous tuning bar, figure 3 the discontinuous tuning bar. For further explanation see text.

quency (difference of N vibs.) is obtained. The tuning effect of a load applied at the node is zero. Its effect is maximum when applied at the end of the bar. Hence the mass of the load thus found will give a tuning range of N vibrations when moved from the end to the node.

The tuning load may be filed or drilled until the desired tuning range is obtained. Of course the smaller the range the more delicate the scale that can be calibrated. It is possible to use two separate riders and calibrate both sides of the bar; or, by slotting both ends of the bar, four riders and four scales may be used.

It is very laborious to calibrate accurately. Any method applicable to a fork, however, may be used in calibrating a bar. The scale units form a geometrical series and not an arithmetical.

II. For discontinuous tuning a bolt (Fig. 3, a) carrying a set-nut (b) is fastened firmly to the bar. A series of slotted washers (one of which is shown in place at c) corresponding to any desired series of frequency increments,⁷ is so devised that any member of the

⁷The series of increments recommended by the committee of the American Psychological Association on the standardization of experimental tests is: .5, 1, 2, 3, 5, 12, 17, 23, 30 vd. above the standard (A 435 vd.).

series may be slid into place about the bolt and locked firmly to the bar. The bolt is slightly beveled so that the slotted washer will always come to the same position relative to the node; otherwise the tuning effect of a washer would not be constant. Of course the washers are plainly stamped with their vibration increment values.

The washers vary in thickness and in diameter. For very large increments it is desirable to load both ends of the bar.

The first form⁸ of the tunable bar is adaptable to the most refined laboratory experiments upon the tonal DL. The second form is adaptable to tests of auditory acuity, since a quick and accurate adjustment to certain discrete frequencies may be easily made.

SOME DEMONSTRATIONS WITH A SAMPLE BAR AND A STETHOSCOPE

With a simple bar and a stethoscope a number of interesting demonstrations can be made.

No Interaural Interference.—The portion of the bar between the nodes vibrates in opposite phase from those portions between the nodes and the ends (Fig. 1). The ends of the bar are up while the center is down and on the rebound the ends are down while the center is up.

If we lead a tube from one ear to the center of the bar and another tube from the other ear to the end of the bar, the ears are receiving sound waves of constant frequency and of approximately the same amplitude but with a phase difference of 180 degrees. There is, however, no interaural interference. A tone is heard as loud and distinct as when both tubes are over the middle, or both over the ends, *i. e.*, a single tone is heard which is not diminished intensively by an interaural phase difference of 180 degrees.

That the two tones are, in fact, of opposite phase may be demonstrated as follows: connect the stethoscope so that both ear-tubes lead into a single receiving tube. At the end of this receiving tube connect a Y-tube so that there are now two sound-receiving open-

⁸ We have corresponded with C. H. Stoelting Co., 3037-3047 Carroll Ave., Chicago, regarding the manufacture of tunable bars, and we are informed that the form described under I above can be supplied for \$25.00 and the form described under II for from \$12.00 to \$13.00. The high cost of manufacture is due principally to the difficulties of accurate calibration. Unfortunately the Stoelting Co. has so far been unable to complete the first set ordered by us. The bars are so simple in construction, however, that they may be made in almost any shop. Eventually, it would seem, bars should be manufactured at a price less than forks.

ings. Now adjust the Y-tube so that the two openings are equidistant from the node and on opposite sides. With this adjustment no tone will be heard. The physical vibrations are of opposite phase and there is complete interference. If either end of the Y-tube be covered with a card, a tone will be heard; or if the Y-tube be moved so that either end is at the node, a tone will be heard since the vibratory motion at the node is zero.

This demonstration is not without theoretical significance, since it proves that the ears to a certain extent are functionally independent. At least a phase difference of 180 degrees between the ears produces no physiological interference.

Relation between Amplitude of Vibration and Intensity of Tone.—Since the amplitude of vibration is zero at the nodes and maximum at the ends and center (Fig. 1) it follows that the intensity of tone heard through a stethoscope should be zero when the stethoscope is at the nodes and maximum when it is at the center and ends. In fact, if the stethoscope be moved along the vibrating bar, the intensity of tone will decrease from maximum at the end to zero (or nearly zero) at the node. It will then increase to maximum at the center and decrease to zero at the other node. Again it will increase to maximum as the stethoscope is moved toward the other end of the bar. Intensity of tone is thus seen to be correlated with amplitude of vibration.

Intensity Difference and Localization.—If a simple tube be led from one ear to the end of the bar, a tone of maximum intensity will be heard and localized at that ear. If, similarly, another tube be led from the other ear to the node, the localization remains unchanged since no tone is audible at the node. Now with the two ear tubes in the above positions they may be moved along the bar keeping the distance between them constant. By so moving them the intensity is decreased from maximum to zero in one ear and simultaneously increased from zero to maximum in the other ear. This change causes a change of localization from ear to ear. In the intermediate region a single tone is localized in the center of the head. Sometimes two tones are heard with two localizations.

This is a simple demonstration of the fact that interaural difference of intensity is a factor in localization.

Phase-reversal Beats.—If the stethoscope be connected so that there is a single receiving tube, and this tube be moved back and forth across the node, a distinct pulse will be heard every time the node is crossed. If the tube be moved rapidly back and forth a

series of pulses, due to phase reversals, will be heard. Such a series resembles beats.⁹

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⁹ We have made a few tests on "phase-reversal tones" obtained by rapid alternation of phase, but our results as yet are too meager to publish.

GENERAL REVIEWS AND SUMMARIES

EDUCATIONAL PSYCHOLOGY

BY C. TRUMAN GRAY

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Although the country has been in a very unsettled condition and many psychologists have gone into war work, yet the number of contributions to the topic at hand compares favorably with other periods.

Texts, Monographs and General Articles.—Freeman's (24) book on *How Children Learn* contains chapters on different types of responses, speech, skill, perception, memory, and formal discipline. In each chapter the author has stressed the growth and development of a particular mental function during the life of the child, instead of giving a detailed analysis of the final form of each of the mental activities treated. The chapter which treats of the nervous system is concise, but in the language of the author, it is probably sufficient to lead students to see "that mental development is dependent upon certain physiological changes which require time and suitable training for their accomplishment." The chapter devoted to formal discipline emphasizes the point that much of the discussion upon this topic centers about the question as to whether a small amount of transfer is important, rather than whether there is transfer. The book can be used to advantage for reading circle work, and for courses in education.

Gordon's (27) *Educational Psychology* is written from the standpoint that educational psychology is an application of general psychology. This point of view is well illustrated in Chapter VI. This chapter contains a general treatment of sensory capacities and ends with certain "pedagogical corollaries." Two important topics which have been omitted in most texts are included in the chapter on motor capacities. These topics are voice control and breathing. On the other hand many teachers will feel that certain topics such as dreams and cutaneous sensation have been over emphasized. The experiment upon the syllogism by means of color circles is unique and results from a much larger number of children than that

reported would be of much interest. The book closes with chapters on language, drawing, and arithmetic.

Starch's (89) *Experiments in Educational Psychology* has been revised. The revision consists largely in the addition of experiments upon individual differences, abilities in school subjects, the distribution of teachers' marks, and a chapter on the coefficient of correlation. This material will contribute much to the usefulness of the book.

Valentine's (100) *Manual* is an attempt to adopt the experiments of general psychology to education. Twenty-seven experiments which illustrate general psychological laws are included. The experiments are described rather briefly and require no apparatus. The second part of the book presents a discussion of the bearing of the general laws illustrated by the experiments upon education.

Two monographs in the series of education studies from Johns Hopkins University have appeared. The first of these by Weglein (102) is entitled *The Correlation of Abilities of High School Pupils*, and a second by Johnson (44) treats of *Motor Abilities of Children in the Primary Grades*. The first uses school grades as a basis for the correlations determined. The second deals with the rate of voluntary movements, steadiness of motor control, reaction time, accuracy of movement, and preference in side of body used. Under this same general heading the following topics have been treated in articles by various authors: Control of emotions by Henry (38); imagination of children by Hindshaw (39) and Parsons (75); memory by Gates (25), Mulhall (70), Myers (71), and Willet (105); association by Anderson (1); visual instruction by Erickson and King (22), and Sumstine (90); superior children by Race (80); and the failing pupil by Wake (101).

Correlations of Mental Abilities.—Various types of problems under this general topic have been reported upon by Brandenburg (13), James (42), King (50), McCall (55), Wilson (108), Thorndike (96), and by the Educational Officer of London Co. Council (21).

Secondary Education.—In this field two books have appeared. One of these is by Colvin (17) entitled, *An Introduction to High School Teaching*. According to the preface it is a book for prospective teachers although inexperienced teachers in high schools may receive help from it. It contains chapters on the following topics: The high school pupil, discipline, punishment and classroom procedure. The appendix contains an outline to be used in observation work, and also samples of lesson plans. The chief contribution of the

book seems to lie in the great wealth of concrete illustrations used throughout the book. To illustrate, after the discussion of "incipient disorder" there follows an illustration of this phase of discipline as reported from a school room. It is this type of material which makes the book exceedingly valuable for inexperienced teachers.

The second book in this general field is one by Inglis (41) on *Principles of Secondary Education*. This volume of more than 700 pages is divided into three separate parts. Part I is devoted to a consideration of the child, Part II considers the high school as an institution, while Part III is given over to the curriculum. A few of the topics considered are physical and mental traits of high school children, individual differences, aims of secondary education and the place which each of the study groups has in the field of aims. The book is filled with tables, charts and graphs taken from the many different investigations summarized in the book. Such summaries are especially valuable for teachers in service who do not have ample library facilities.

Educational Tests and Measurements.—Monroe, DeVoss, and Kelly (68) have brought together materials upon various educational tests and scales in the form of a text. The book begins with a chapter on school grades. This material is used to illustrate the need of more accurate methods of measurement. Tests and scales in the various school subjects are then considered. In this connection a chapter is devoted to each of the following subjects:—arithmetic, reading, spelling, handwriting, language, and the high school subjects. Each chapter discusses the problem of measurement and describes in some detail the various tests and scales which have been devised. In addition to this, certain other topics of importance are treated. To illustrate, the discussion of arithmetic considers how to handle what the tests reveal and the chapter on reading treats of the service of reading tests. It would seem that this part of the book might have included more critical evaluations than are given and that certain typical derivations might have been included. In addition to the material already mentioned the book contains chapters on statistical methods, the meaning of scores, derivation of tests and examinations, and uses of standards in the supervision of instruction.

Part II of the Seventeenth Year Book (73) is entitled "The Measurement of Educational Products." It consists of chapters upon the various phases of the problem. Each chapter is written

by a different individual. One of the most useful of these chapters is by Monroe. This author lists the various tests and scales and gives the publishers of each. The volume includes a bibliography of more than six hundred references.

Rugg's book on statistical methods considers the various problems and laws in this field which apply to educational work. The book is replete with graphs, charts and tables, all of which have educational data as their basis. No treatment of partial correlation is included. Owing to the growing importance of this phase of statistical procedure, it seems that a chapter on this topic should be included in books of this type. The book will be a valuable supplement to such texts as Thorndike's and Yule's.

An article by McCall (56) dealing with criteria for determining which test to use and an article by McCall and Ruger (57) on the reliability of a thesis upon educational psychology should be mentioned at this point.

Algebra.—A monograph in this field by Rugg and Clark (82) attacks the problem of reconstruction of ninth grade mathematics. It begins with a vigorous plea for "rebuilding" the course of study in this grade. This is followed by an inventory and history of the present course, and a consideration of standardized tests in relation to the problem at hand. A later chapter is given to a careful and detailed analysis of the contribution which high school mathematics had opportunity to make in training in thinking. The methods used should give results in the rebuilding of this part of the course of study.

Arithmetic.—A monograph by Counts (18) gives an account of part of the work done with the tests used in the Cleveland and Grand Rapids Surveys. The first part of the study is devoted to a description of the tests and certain general results similar to those usually obtained by means of the Courtis tests. In this part of the treatise one section deals with diagnosis. The chapter of most interest to teachers is that given over to a study of errors. The errors studied were those in simple addition, simple subtraction, simple multiplication, simple division, and fractions. A study of this chapter reveals to teachers certain points of emphasis for their work. The chapter dealing with comparisons of the arithmetical abilities of certain age and promotion groups shows that younger groups are more accurate than the older groups, but that there is little or no difference in the number of problems attempted in the groups. The book closes with a chapter which compares the arithmetical ability of certain race groups.

The articles which have appeared upon various phases of arithmetical ability may be listed as follows: diagnosis, Uhl (98); fundamental number facts, Brush (15); errors, Scott (86), and Gist (26); waste in arithmetic, Chase (16); correlation of oral and written work, Wilson (107); ability to place the decimal point, Monroe (66); and various uses of scales and tests, Drushel (20), Monroe (65), Heckert (36), Green (31), Hanus and Gaylord (35), and Wood (109).

Biology.—A method for measuring ability in this subject which takes the form of an information test has been devised by Grier (32). The material for the test is taken from the subject matter of the course given in the subject.

Chemistry.—The first attempts at measurement in this field have been made by Bell (4) and Wiley (104).

Composition and Grammar.—Errors in English work have been reported upon by Diebel and Sears (19) and (87) and Johnson (45). Various tests have been used by Kelly (48), Willing (106), Theisen (92), and Trabue (97).

Geography.—In this subject a new scale by Hahn and Lackey (34) has appeared. The scale is of interest because it represents an attempt to carry over into this field the method developed by Ayres in his spelling scale.

Geometry.—A monograph by Minnick (64) attacks for the first time in any extensive way the problem involved here. The author assumes that certain abilities are essential to the study of geometry. These abilities are listed as follows: (1) The ability to draw the figure, (2) the ability to state the hypothesis and conclusion, (3) the ability to recall facts concerning the figure, (4) the ability to select and organize facts so as to produce the proof. A series of tests for measuring these abilities is then set forth. The body of the monograph is taken up with methods for evaluating the tests and determining the correlations between school grades and the results obtained by means of the tests.

Handwriting.—New scales by Zaner and Blossom (110), by the Bureau of Research and Efficiency, Kansas City, Mo. (14), and by Ayres (2), are now being used. The Ayres scale makes use of samples of handwriting upon ruled paper and standards for both speed and quality are printed upon the same sheet with the scale. Other authors who have contributed to this subject are Manuel (59), Koos (52), Breed (9), and Kimmins (51).

History.—The contributions to this subject consist of a scale in

ancient history by Sackett (84), and articles by Bell and McCollum (5), and Myers (72).

Latin.—The measurement of ability in Latin has been undertaken by Henmon (37).

Music.—A study of ability in instrumental music has been made by Pond (78).

Reading.—Gray's (28) monograph on types of reading ability is an attempt to analyze reading ability by means of tests and experiments. Tests for both oral and silent reading are used. These tests bring out many differences in ability. A more fundamental analysis of the differences is made by means of experiments in perception and the motor phases of reading ability. These experiments indicate clearly that many of the differences indicated in the tests go back to certain differences in perceptual and motor abilities. The final chapter is given over to certain remedial types of instructions for children who had difficulty with their reading.

Two new scales for measuring reading ability are now in use, one for oral reading has been devised by Price (79) and the second which is to be used in silent reading, has been worked out by Monroe (69).

Articles on various phases of the reading problem have appeared as follows: the diagnosis of reading ability, Zirbes (113) and Uhl (99); difficulties in silent reading, Thorndike (93, 94); skimming, Whipple and Curtis (103); alexia, Schmitt (85); influence of special drills, Peters (76); silent versus oral reading, Mead (61); and various use of different tests and scales, Breed (8), Gray (29 and 30), Haggerty and Thomas (33), Kelly (47), McLeod (58) and Zeidler (111).

School Grades.—This topic has been studied by Breed (10), James (43), Inglis (40), Lincoln (54), Maxwell (60), Miller (63), Nicholson (74), Ruggs (81), and Zerbe (112).

Spelling.—Transfer in spelling is treated in articles by Mead (62) and Tidyman and Brown (91), causes of misspelling is reported upon by Kallom (46) and various tests have been used by Ballou (3), Briggs and Bramberger (11), and Brandenburg (12).

Teacher Measurement.—Brief studies are reported by Landsittel (53), Pittenger (77), Sprogue (88) and Bird (6, 7).

If one looks for present tendencies in the body of literature which has been surveyed, such can probably be expressed in terms of diagnosis. A few authors have attacked this problem in a specific way, while others suggest its possibilities and its importance. A large

part of this work in diagnosis represents an attempt to assist a particular teacher with a particular pupil, and stands in definite contrast to the type of work which deals with large numbers of children. If the methods of dealing with the individual pupil are refined and made practicable for the teacher in service, educational measurements will have performed as great a service as it has in the establishment of methods for measuring and in determining standards by the use of such methods.

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CHILD PSYCHOLOGY

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General Discussions.—In *Child Behavior* by Mateer (34) there is an excellent discussion of experimental observations on children. The first four chapters are theoretical and historical. The fields of child study and child behavior are delimited. Child study from very early times is reviewed, with an evaluation of the various experimenters' work. A modification of Krasnogorski's method is used in a study of conditioned reflexes. The subjects included practically all the children up to seven years of age in a small suburban community. Two stimuli were presented. One of them was indifferent for the production of the specified reaction;

the other was the effective stimulus. By this means the mechanism of a conditioned reflex or a stimulus-reaction association could be easily developed. The writer tabulates the number of trials needed for learning, the number necessary to break down the conditioned reflex, the number of trials necessary for re-learning, etc. A chief conclusion is that a study of children by this method can be adapted to varying and multiform conditions. This book should be studied by all students of child behavior, especially when a development of methodology is needed.

Jennings, Watson, Meyer, and Thomas (28) consider the contributions of modern science to child education. Jennings discusses variability in children, and says that there are three things which we must know: (1) the nature of the organism, considering traits and capabilities with resemblance to and difference from other organisms; (2) the laws of development; (3) the effect on their development of things in the world outside, and the conditions necessary for full development. Owing to the manifold and diverse situations in which the child must react, he must retain the ability to adapt himself to situations never met before. Watson deals with the practical and theoretical problems in instinct and habit. From the results of his experimental work he has concluded that fear, rage and joy are the fundamental emotional reactions. Fear is aroused by four stimuli, rage by one, and love by a variety of one type of stimulus. Other stimuli for emotional reactions have become effective by virtue of association with the originally effective stimuli. Four laws for the formation of habits are presented: (1) diminishing returns from practice; (2) the speed of formation is in inverse ratio to the number of habits formed simultaneously; (3) the rapidity of formation is in inverse ratio to the age of the child; (4) the rapidity depends upon the incentive presented.

Meyer shows a development in the field of psychiatry leading out to the school and to the problem of education. The study of the individual, the fundamental unity of the problem of health, and the attempt to get inventories of determining factors in the lives of pupils have led the psychiatrist to a consideration of the child in school. Thomas insists that human behavior seems to represent four fundamental types of interests or wishes. There are desires for new experiences, mastery, recognition, and security. Traditional control is losing its efficacy, and primary group norms are breaking down. The laws of behavior must be established by psychological procedure.

Blanton (7) presents records of observations on the reactions of children during the first month of life. The appearance of the first reflex activities and the use of the various sense organs were observed. Activities are described as being characteristic of children at this age which previous record had credited only to a much later age. Kirkpatrick (31) has issued a revised edition of his stimulating work on child study. Luckev (33) presents a book of thirty-three chapters, each one of which is a lesson on some assigned topic. The book is chiefly of interest to parents or teachers in the initial periods of studying children. It is not a report of experiments made but a résumé of many recorded facts concerning children. He is rather uncritical in the selection of records, somewhat making up for this deficiency by giving an extended list of references for each topic. Drummond (17) builds up the philosophy of mental development on the basis of a study of three children. She suggests that one trust the child's intelligence. Allow him to make his own discoveries and help only when help is wanted.

How Children Learn by Freeman (22) is an able attempt to present the psychology of the learning process in children. He emphasizes the necessity of considering native responses and utilizing them for the development of the child. A simple and fairly clear-cut statement of the nervous system with a differentiation of reflex, instinctive, sensori-motor, and ideational levels is presented. Under the title of "The Relation of Native and Acquired Responses" the old problem of the relative influence of heredity and environment comes up. Play, imitation, self-assertion, and speech are native responses. The acquisition of skill and the development of sensory discrimination are included in the section dealing with acquired responses. Sensory discrimination is probably not developed but greater ability, where development is supposed to have taken place, depends upon knowledge of the situation in which observations are made. In outlining the principles of association, he presents eight rules to help in the process of memorizing. Problems of fatigue, efficiency, neurotic conditions, etc., are discussed and methods of treatment for the neuroses are suggested. To each chapter in the book is appended a list of questions and topics for discussion which adds greatly to the value of the publication.

Von Hug-Hellmuth (52) is chiefly concerned with the psychoanalytic interpretation of the mental life of the child. The first signs of voluntary activity are referred to some auto-erotic tendency. Speech begins when the child is interested in the activities of the

sex organs. Play is also interpreted in the light of erotic ideas, and even the imagination of the girl-child as she arranges her house in order must be recognized as the beginning of the repression of forbidden desires.

Burnham (13) has an extremely valuable discussion on the relation of the formation of conditioned reflexes to the problems of health, pedagogy, etc. He reviews the work of various experimenters in this field and shows the difference between the mechanisms of the conditioned reflex in the child and in the animal. In the child the acquisition is more rapid, has a higher stability, and yet may more easily be broken down. In a study of conditioned reflexes light is thrown on many problems in human behavior. Not only the obvious phenomena of habit and association, but also the peculiar behavior of many children, the tricks and mannerisms and forms of misbehavior in normal as well as in hysterical and abnormal children are more easily understood. The same author (14) discusses the value of the formation of habits, and the relation of the earlier acquired habits to those acquired later. Each habit should be propaedeutic to succeeding ones and none should be formed which would greatly interfere with variability in reaction to meet changing conditions. In "Mental Health for Normal Children" (12) he outlines seven requirements, including opportunity for the functioning of natural instincts and impulses, training in the control of impulses by direction into other channels of activity, the development of an active attitude in the face of difficulties, etc.

Bruce (9) almost entirely ignores the notion of a biological variation in children. He makes removable conditions responsible for practically all the variations among them. Beery (5) writes a parents' manual outlining a system for child training. In *Child Psychology in the Normal School*, Averill (1) places emphasis on the requirements of psychological study in the normal school. Its purpose is to acquaint the young teacher with the process of mental development in children, arousing in her a sympathetic attitude toward their problems. Opportunity should therefore be given for observation and the study of children. This may be done by specific hours of class observation or by observing children in whatever situations and at whatever times it is possible. Questions which should be asked children in order to obtain first hand information are suggested.

Language and Speech Development.—Bateman (2) gathers available information in regard to the first word spoken by a child

in order to show the time of its appearance and its character. This word has been used at ages varying from eight to fifteen months, with the most frequent occurrences at ten months. The chief criticism of these determinations is the variability in the conception of the first word. Certain sounds are used which have no connection with, and no similarity to, the sounds used in ordinary conversation to express the idea. A clear definition of what is meant by the use of a word would greatly assist in further study of language development. Nice (38) makes an analysis of an individual child, originally left-handed, who had been taught to use the right hand and who talked fast and stammered when excited. She considers the establishment of a norm of speech development and presents a more or less detailed report of seven cases, each of which had shown some defect in speech and all of whom had been taught to use the right hand when the left was the more usable. Swindle (49) discusses the beginning of enunciation and the formation of vocal responses of certain birds and of the human being. This is an important article for the understanding of the speech mechanism and should be carefully studied by those who attempt to train speech cases.

Walsh (55) had four questions to answer; the number of children with defective speech, the nature of the defects, the causes, and the methods of treatment and training. She investigated ninety-one children in five ungraded classes and used all of the consonants in initial, middle, and final positions. The types of defect are lisping, stuttering, and unintelligible speech. Osborne (40) divides speech defects into two groups, phonetic and stuttering, the first of which are marks of defective brain development, and the second characteristic of children with at least normal mentality. Speech defects as seen by teachers are classified and etiological factors are discussed.

Roper (45) insists that many of the faults in speech may be eradicated by an intelligent teacher who has time to experiment with the problem. The chief suggestion for training is that of "mouth mapping" in which the movements of lips, tongue, and palate should be determined. Swift (48) reports a method of treatment which has been, according to him, very satisfactory, but he is probably mistaken in the factors which he describes as casual. He insists that the improvement was due to "clarified visual imagery," but the probability is that practice and training in correct habits were responsible. Bryant (11) says that stammering is a functional disturbance due to an interruption of the normal functions of the

mind in relation to speech. More than half of 20,000 stammerers observed, had relatives afflicted with some form of nervous speech disorder. He concludes that stammering is an inherited characteristic.

Dunlap's (18) new theory of causal factors in stuttering is interesting. Since it is much more frequent among boys than among girls, the cause must be found in some peculiarity of the language function in the male. The fact that stuttering dates from the beginning of the school period, and also that there is special difficulty on words beginning with certain sounds leads the author to the conclusion that stuttering is connected with the use of obscene or profane expressions. Lacking a neurotic constitution a boy may keep his linguistic personalities distinct but the boy predisposed by inherited tendency to erratic muscular activity is very apt to become a stutterer. The theory does not explain all the cases of stuttering but it should lead parents to avoid harsh condemnation of a boy's language.

Fletcher (21) criticises the various theories of stuttering and reviews both the Freudian hypothesis and the visual-imagery theory of Swift. He insists that there are no permanent peculiarities of imagery, that no pure imagery type is found, and that the stutterer has a tendency to lose all forms of imagery immediately before speaking. Tompkins (51) concerns himself largely with a criticism of Dunlap's theory. He considers the question of sex ratio, insisting that in the beginning stammering is about equal between the two sexes. He says that the evidence of causation, accident, fright, illness, etc., is discounted without counter-evidence being presented. Wallin (54) discusses various theories and reports the case of a twelve-year old boy who began stuttering at two and a half years of age. Dream analysis and the association-reaction method of diagnosis, his procedure in which he describes in detail, offered no solution. Neither was auditory amnesia responsible for the stuttering. The chief factor in training is the development of a habit of slow enunciation with a good physical condition as the background. Brummeler (10) presents specific instructions for the training of speech defectives. He insists that a readjustment of physical condition and an analysis of mental and emotional attitude, besides vocal training are necessary.

Natural Education.—Montessori (36) has developed her method of education to meet the requirements of children over six years of age. In a second publication (37) she gives information concerning

the material necessary for these children. This publication is divided into seven parts, each section dealing with one of the topics; grammar, reading, arithmetic, geometry, drawing, music, and metrics. In each of these discussions the teacher will probably find something interesting and possibly something new. The great mass of material, however, will be found fairly familiar to studious teachers. Methods are discussed and drills presented which remind one of early undesirable school life. Cook (16) discusses the *Play Way* as a method of education. His comment "The play way is not a bunch of contrivances for making scholarly pursuits pleasurable, but the active philosophy of making pleasurable pursuits valuable," indicates quite clearly the fundamental idea of his publication. He insists that school activities and studies should be brought more into relation with the activity of daily life.

Exceptional Children.—Groszmann (25) uses the term "exceptional" in a very liberal sense. According to him every child is exceptional, since he discusses the psychology, the development, and educational opportunities of all children. The book is one to be used more for reference on individual topics than as a general text book. It aims to consider the child from practically every point of view. One of the valuable sections of the book is a symposium by medical men, presenting various features of the child's physical development. Pugh (44) traces the spiritual, emotional, and intellectual development of an exceptional child in an entertaining and interesting way. He shows an appreciation of children when he says they are "more subtle, more self-contained, more elusive, more baffling in every way than any adult of either sex."

Wallin (53) deals with the problem of the subnormal individual, emphasizing four fundamental factors; differential diagnosis, differentiated educational treatment, adequate system of after-care, and preventive measures. An account of changing attitudes toward the subnormal and a description of provisions for them in various countries are given. He presents a résumé of studies including the following facts: the institution in which the study was made; the examiner; the subject, indicating the number, sex, type, and age; the method of examination; and the basis of classification. One chapter considers the solution of problems and answers to questions which one meets in an attempt to deal with the feeble-minded. In a chapter on the "Hygiene of Eugenic Generation" he considers hereditary characteristics and includes discussions of methods for the elimination of defectives.

Campbell (15) distinguishes between neurotic and subnormal children and emphasizes the characteristics of the problems which the two types present. He reports a survey of all the children of school age in one district. The number of subnormal children and approximately the degree of defect were determined. The results may not be considered typical for an entire city, but for a district of similar characteristics they are representative. He studies the subnormal children in detail, and presents tables which include chronological age, Binet-Simon age, pedagogical age, hereditary characteristics, etc.

Strong (47) on the basis of experimental work with 115 children studied the effect of hookworm disease on mental and physical development. Seven mental tests and six physical tests were used. The methods of administering each test or taking each measurement are described, and norms of performance with conclusions from each of the tests are presented. He says that the disease interferes radically with mental development. Treatment alleviates the condition but the child's progress is not as rapid as it would have been had he not had the disease. The longer he has suffered from the disease the greater is the mental loss and the less rapid is his development following treatment. Similar conclusions are pre-presented in reference to the physical development.

Special Topics.—Long (32) presents interpretations of child problems concerning which one almost invariably wonders if a simpler explanation would not have been equally satisfactory. The writer is to be congratulated on giving clearer indications of psychoanalytic procedure, on the results of which very important and far reaching conclusions are frequently based. In Oberndorf's (39) report on the emotional life of a child the chief consideration is the psychoanalytic interpretation.

According to Henry (26) the education of the emotions has been ignored because, (a) the school is intended primarily for intellectual purposes, (b) we lack an appreciation of the value of emotions, and (c) we are ignorant of a method of training. Watson and Morgan (56), from observations on a large number of infants during the first months of life, come to the conclusion that there are three fundamental emotional reactions, and that the stimuli which call them out originally are simple and crude. Current theories of the emotions are superficial and not sufficient to explain the enormous complexity of reactions.

Brown (8) makes a plea for allowing the child to go out into the

world unhandicapped by adult-determined views on the nature of life. The child should be free to acquire at first hand "the wisdom of all the ages." Kimmins (30) examined 1,430 papers written by boys and girls of about eleven years of age. The papers discussed the problems of war activities and the relation of children to them. The author finds fundamental sex differences and quotes statements which indicate them. Tanner (50) tabulates the responses of school children to three moral propositions involving stealing, lying, and dishonesty in school work. Tables showing percentages of various responses to each of the three situations are presented. Baumgarten (3) used the questionnaire method to investigate the prevalence of falsehood. He considers falsehood in the home, in the school, and the occasion of the first falsehood. The proverbial statement, that girls are more prone to lying than boys, is denied. Smith (46) introspects concerning his own childhood, relating the imaginings and adventures of that period. He appreciates childhood desires and inspires an attitude of observation rather than control of children. Glenconner (23) records the mental development of five children. Some of the observations indicate the lack of a scientific criticism.

Experimental Studies.—Hunter (27) experimented with his daughter between the ages of thirteen and sixteen months, at which time she had not acquired the ability to use words as a means of communication. He wished to determine the accuracy of reaction after certain intervals of delay. Three boxes were set before the subject, and in one of these the stimulus object was placed. After ascertaining that the child had understood the placement, he used various methods to prevent the child's attention being directed to the box. The reaction times and the per cents of accuracy in the child's choice of the box after varying lengths of distraction intervals are presented. Woodrow and Lowell (57) studied children's associations. The stimulus words used were ninety of the Kent-Rosanoff series and ten other words substituted for the most difficult of this series. The responses of a thousand children, ranging in age from nine to twelve, are tabulated. Enormous differences between children's and adults' associations are shown. Children give fewer individual responses and fewer different words in response to a given stimulus.

Pintner (42) asked children, six to fourteen years of age, to arrange six pictures in the order of their preference. The pictures were different reproductions of the same theme, changes being made

in the accuracy of drawing, the perspective, and the coloring. In the six year group there is no decided preference. As age increases the evidence of preference increases. "Æsthetic judgment would seem to become more uniform as the child grows older." Pintner and Toops (43) arranged a series of twenty five pictures, from each picture an essential part being omitted. They used the series with deaf and hearing children, six to fifteen years of age. The children were directed to draw the part of the picture which had been omitted. The results are shown in a table of per cents of accuracy for each picture with each age. On the basis of these percentages the writers select a group of pictures to form a shorter scale which should give equally valuable results.

Fifty-two boys and forty-five girls, seven to seven and a half years of age, were the subjects of an experiment by Parsons (41) on the interpretation of ink-blots. He presents a classification of responses, using the method adopted by Miss Sharp and discusses other classifications. He considers the use of active and passive imagination, and the method of description adopted by the subjects. There is a tendency to use active imagination and non-constructive rather than constructive associations. The author says that children, like adults, are most interested in living things. Mead (35) made physical measurements and mental evaluations of 430 feeble-minded and 480 normal children. Besides presenting individual records, he shows that, as a group, the brighter children are heavier and taller, stronger and less variable in the strength of right and left hand than are the defective children. In memory and perception the defective children are not equal to the normal but in these two characteristics they are better than in any others.

Beely (4) describes a method for determining handedness in children, four to eight years of age. He reviews the methods which had been used and describes his experiments with tapping, steadiness, and tracing tests. He concludes that tapping correlates more closely with handedness than steadiness and tracing, and that wrist tapping is superior to arm tapping. His final chapter summarizes the literature on left handedness, dealing with its prevalence, origin, cause, and inheritance. Evard (20) used the association method with children of seven to ten years of age, on two occasions separated by an interval of a year. She compares the results for the group of thirty-two children, and also for individuals. Three different methods of classification are used and the author says that while the results are not conclusive they tend to attract attention to this

unlimited field of investigation. Bickersteth (6) used twelve tests, including motor, discrimination, memory, and attention problems. A detailed discussion is given of each of the tests and many correlations are presented.

English (19) wished to measure the difference in ability between children of different social levels. He used fourteen tests, including quickness and accuracy of movement, quickness of perceptual discrimination, and ability to distribute attention, on 68 children. He describes each test and presents results in graphic and tabular form. He concludes that the upper social group is superior in intelligence. Gould (24) measured the coordination of children trained in industrial occupations and those trained in different lines of activity. Three tests, thrusting, hammering, and the three-hole test, give results from which the conclusion is reached that there is no improvement in manual accuracy among the prevocational group in work which is more or less different from the shop work. Johnson (29) surveys the results obtained in various investigations on motor ability. Her experimental work included voluntary movement, steadiness or motor control, reaction time, and accuracy of movement. She describes the apparatus and method of conducting the tests and presents a statement of the subjects used and a discussion of the results. Sex difference, improvement with practice, and greater relative efficiency of the right hand in childhood are shown.

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NOTES AND NEWS

THE August number of the BULLETIN was edited under the direction of Professor R. P. Angier and W. S. Hunter, as a combined physiological and a comparative psychology number.

THE present number of the BULLETIN was prepared under the editorial direction of Professor B. T. Baldwin.

A NUMBER of psychologists have been engaged in the physical reconstruction work in connection with Army hospitals. Besides Major M. E. Haggerty, who is mainly employed at the Surgeon General's office, Major B. T. Baldwin, Professor J. W. Baird, Dr. Buford Johnson, Dr. Ethel Bowman, and Lieut. Bruce Moore are at work at the Walter Reed General Hospital, Washington, D. C., Capt. Hughes H. Mearns is at Fort McHenry, and Capt. Louis Pechstein is at Base Hospital No. 11, Cape May, N. J. It is expected that many other psychological workers, commissioned and civilian, will be needed at a later date.

THE
PSYCHOLOGICAL BULLETIN

A PNEUMOGRAPH FOR INSPIRATION-EXPIRATION
RATIOS

BY HAROLD E. BURTT

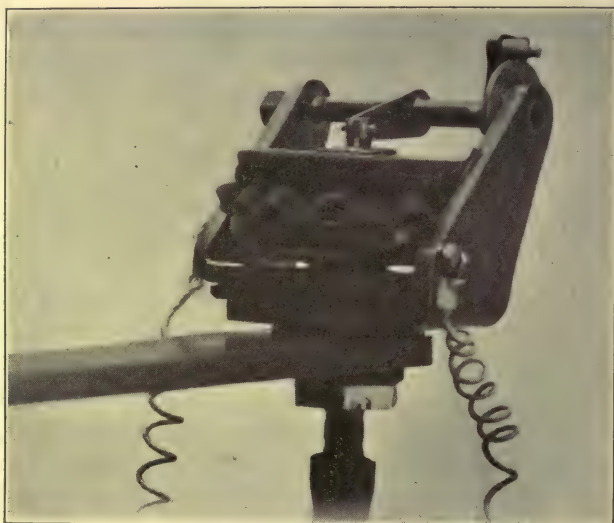
Harvard University

There are many experimental situations in which the principal interest is the relation between inspiration and expiration times. With the usual pneumographic technique the accurate determination of these times is difficult and tedious for the following reasons: (1) the exact peak of the curve must be determined, *i. e.*, the exact point where inspiration or expiration begins; (2) these peaks must be projected onto a horizontal line; (3) the distances between the projected points must be measured carefully (assuming that the kymograph has a constant speed) or compared with a time line. The present method (1) *automatically* records the instant inspiration or expiration begins; (2) obviates the necessity of geometrical projection; (3) eliminates errors in measuring distances or comparing with time lines by incorporating the time record in the breathing record, either on the kymograph or on electric counters.

The crucial part of the apparatus is shown in the accompanying photograph.¹ Its function is to close an electric circuit from the beginning of an inspiration until the beginning of the following expiration or vice versa according to connections. A pneumograph (Sumner's works very well) is connected in the ordinary manner to a tambour. The usual metal disc is glued to the rubber and the lever pivoted to this is fastened rigidly to a shaft. This shaft is pointed for conical bearings, one in an adjusting screw which pro-

¹ The mechanical details of the part illustrated were worked out in the present form mainly by Mr. A. G. Cox.

jects through one side of the base and the other in a piece of fiber (mentioned below). The latter end of the shaft projects through a short arm soldered to it at right angles. On the end of this arm are a silver pin and an ivory (or other non-conducting) pin close together and equidistant from the axis of rotation. A disc with radius slightly less than the distance from the axis of rotation to the two pins is shouldered to bear in a hole in the side of the base opposite the adjusting screw. The disc with its shoulder has a tight-fitting core of fiber. The pointed end of the shaft bears in a hole in the center of this fiber. The disc has a silver pin of diameter slightly



less than the distance between the other two pins projecting between these two pins. Thus as the tambour operates pneumatically the arm with the two pins moves through an arc carrying the disc with it. The shaft with its conical bearings moves very delicately while the disc with its shoulder possesses more friction. The two are insulated by the fiber bearing. The sides of the base are insulated from each other and a wire attached to each. Thus the current enters one base, goes through the adjusting screw, shaft, arm and silver pin on the arm to the other silver pin and out through the disc and other base. The slight friction in the disc enables the silver pins to make a good contact while the tambour moves in one direction. When the tambour starts in the other direction the current is broken, for the disc remains stationary while the arm

moves, but the ivory pin immediately engages the pin on the disc and carries it along so it is ready for another contact when the tambour reverses, regardless of the amplitude or duration of the breath. There is just enough play between the two pins to allow a breaking of the contact. The entire system rotating about the same axis insures a good make and break.

The present piece of apparatus works successfully in the form described. It is possible however that adjustment of the friction in the disc may at some time be necessary. The disc can be shouldered down until it turns too easily and a fine screw threaded into the fiber core from the outside. This screw carries with it a spring washer which will press against the base with any desired force, thus producing a controllable amount of friction. It is very essential that the shaft and arm move very easily and that the disc move as easily as is compatible with its staying in one position when no force but gravity is operating on it. The pressure of the pointed shaft in the center of the core improves the bearing of the disc and the absence of any wires trailing from the moving members is a necessary feature. The apparatus is relatively small,—the tambour being one inch in diameter.

Three methods have been found successful in recording results with the above one-way contact device. The circuit may be led through an ordinary signal magnet, recording on a kymograph. It will trace on one level during inspiration and on another during expiration. The distances may be measured directly if desired but it is more satisfactory to rivet a light iron disc to the marking lever parallel to the surface of the drum and place a second magnet opposite this with its core perpendicular to the drum. This second magnet is in series with an interrupter (mercury cup, magnet and spring steel vibrator on the door-bell principle) and thus periodically pulls the writing lever away from the smoked surface. There is sufficient spring in the lever to carry it back to the drum when released by the magnet. The lever thus traces a dotted line in, for example, fifths of a second, and by counting dots on the two levels the inspiration-expiration relation can be determined.

A second method which does not require as delicate adjustment and is somewhat easier to read is as follows: The pneumograph circuit operates the magnet of a double relay. Two signal magnets are arranged one above the other to trace on the kymograph. They have one pole in common and the other two are connected to the two outer contacts of the relay while the common armature of the

relay leads to the interrupter circuit. Thus one marker is operating five times a second, *i. e.*, tracing alternately on two levels at that rate, while the relay magnet is open. The other marker does likewise and the first traces an unbroken line when the relay magnet is closed by the pneumograph. To compute inspiration time it is necessary to count the indentations in the line traced by one marker and for the following expiration time count those traced by the other marker. These markers will operate with a relatively rough adjustment against the kymograph, whereas the other arrangement which traces the dotted lines needs careful adjustment and is vitiated by any unevenness in the smoked paper.

A third method is still better if the nature of the experiment is such that the experimenter has to pay little attention to the subject during the actual taking of the breathing record. It consists of substituting for the signal magnets in the preceding method two electric counters.¹ One counter records five numbers a second during inspiration and the other does likewise during expiration. The experimenter writes alternately the readings of the counters during the period when each is stationary. For example, during inspiration of the subject, the experimenter records the reading of the expiration counter. By subtracting the successive readings in the two columns one has the time in fifths of a second of inspiration and expiration.

These methods make it possible to obtain the inspiration-expiration ratio with considerably more accuracy and considerably less labor than in the ordinary procedure. There is an additional advantage that while the contact arrangement is located conveniently near the subject, the actual recording apparatus can be at any distance, even in another room.

THE LEARNING PROCESS²

BY EDWARD K. STRONG, JR.

I. *How Does One Learn?*—Rookies are awkward and know nothing of drill. Later they march and drill with marvelous precision. The fact that such changes occur is so commonplace that

¹ A satisfactory form of counter is made by mounting an armature on the shaft of a "Veeder" counter which registers a digit on a turn of about forty-five degrees. This armature is between the poles of electromagnets, sets itself across the poles when the current flows and is partially rotated by a spiral spring when the current breaks.

² Outlines of the Study of Human Action for the Students' Army Training Corps, Section 3.

it does not attract our attention. But if we stop to think about it, the whole process challenges our interest. What has occurred so that awkwardness is replaced with skill? The word "drill" does not explain the matter. For constant repetition does not cause a machine to turn out a more and more refined product. Nor does man necessarily become more and more accurate in his movements through continued repetition. Frank B. Gilbreth has shown us that the average bricklayer today lays 120 bricks per hour—a rate which has probably not increased at all for generations despite the fact that millions of men have practised the trade. But such a bricklayer can lay 350 bricks per hour and moreover be less fatigued at the end of the day. Gilbreth has reduced the motions of a bricklayer from 18 to 5, principally through having the helper supply the bricks in a more convenient manner and at the height of the bricklayer's belt. In this way the effort of lowering one's body down two feet and raising it up again every time a brick (weighing 5 pounds) is laid in the wall is eliminated. Here there has been something added besides mere repetition (drill) which has greatly increased the proficiency of the worker. What was it?

To throw some light on this subject, carry out the following very simple experiment. Be careful to execute the instructions as given.

Call upon your room mate to recite the alphabet as rapidly as possible. Time him and record the number of seconds. Also note any mistakes made. Repeat this for ten times. Now call upon him to recite the alphabet backwards, timing him each time and recording his mistakes as well as you can. (It is well in both cases to have the alphabet written out before you so that your eye can follow his progress: mistakes are thus more easily detected and recorded.)

Now plot your data on coördinate paper. Along the base line, number equal steps from 0, 1, 2, etc., up to 10, representing the ten successive trials. Along the vertical axis number equal steps from 0 up to the longest time recorded in saying the alphabet backwards. Zero of each scale should be at the lower left hand corner of your chart. Plot the data from the two experiments:

Now write out your answers to the following questions.

(1) How do your two learning curves agree? (Note down all agreements, however trivial they may seem.) Explain. (2) How do your two learning curves differ? Explain why. (3) What other changes took place besides those of increasing speed? To what

extent were they important factors in the learning? (4) The command has been the same in each experiment, being, "Now, recite the alphabet," or "Now, recite the alphabet backwards." In other words, the *situation* confronting your room mate was the same, but his *response* differed each time. How can you explain the change? (5) If you could secure a record of the time required and number of mistakes made each time you respond to the command (situation) "Right shoulder arms" would you get a similar record to that of saying the alphabet backwards? Explain. (6) Is it natural to expect noticeable progress the first few times one does any new performance and then less and less progress until the progress becomes too slight to be noticed? Is there any relationship between such a phenomenon and loss of morale when troops are kept in camp a long time? Prepare to hand in this exercise at the next class hour.

II. *Why do Recruits Fluctuate between Well and Poorly Executed Movements While Learning?*—If we watch a recruit "right shoulder arms" we will notice one time he does exceedingly well and possibly the next ten times he will do poorly, only to surprise us again with a well executed movement. Later on he will ordinarily do well but from time to time lapse into a poorly executed performance. Is this the natural course of events or is it due to the way he has been taught and is handled?

In the previous part we discovered some facts which are fundamental to all learning. Note how they hold true as you master such commands as "About face," "Squads right," "Present arms," etc. In order to get a clearer idea of other principles underlying such performances carry out the following.

Lay off on a piece of paper two parallel lines eleven inches long and one inch apart. Draw cross lines an inch apart, so as to have eleven one-inch squares. Place five nickels on the five squares at the extreme left and five cents on the five squares to the right, thus leaving the middle square uncovered. So move the coins that eventually they will have exchanged places. A coin may only be moved forwards or jumped over a single coin of the other kind. Solve this puzzle twenty times. Have your room mate record the time consumed for each solution and the number of false moves made. (There is no catch to the puzzle: it can be solved in a few seconds.)

This puzzle is a comparable situation to that confronting the

average auto driver when his car goes dead, or to the learning of complicated military manoeuvres, or to the inventor's struggles to invent a new method of combating the U-boats.

Plot the learning curve. Write out the answers to the following questions.

(1) How does this learning curve compare with those secured in learning the alphabet? Explain. (2) Why did you again and again make the same identical mistake? (3) How did you come to solve the puzzle? Did you see the correct move and then make it, or vice versa? (4) In teaching the manual of arms should one emphasize speed or accuracy at the beginning? (5) After solving the puzzle 1,000 times, if you then recorded the time of the next 20 trials, how would that curve differ from the curve of your first 20 trials? (6) Is there a limit beyond which you cannot go as to speed and accuracy regardless of the amount of drill? (7) Is it natural to expect awkward movements in drill at the start and content one's self with progress from them to orderly execution, or could one secure correct movements from the start through careful teaching? Hand in your report at the next class hour.

III. *What Relation does Losing One's Temper, etc., Bear to Learning?*—We have all seen individuals lose their temper. They sometimes use unnecessarily vigorous language, and may even kick some object with which they had been tinkering because they could not fix it. Too often we see executives, including officers, lose their temper when men under them do not execute their commands. And on the other hand we see subordinates become sullen and stubborn or openly defiant when being instructed in some new performance. Why do men lose their temper at such times? Is there any relationship between learning and annoyance, exasperation and explosive action? If so, can learning be so carried on that there will be no outbursts of temper? Or is it possible that anger is advantageous in learning?

We can distinguish here between (1) one's attitude toward his work, one's feeling, and (2) one's method or "mode of attack" in the work.

Ruger in *The Psychology of Efficiency* (pp. 36-39) calls attention to three different general attitudes toward one's work. He calls them (1) The self-attentive attitude, (2) the suggestible attitude, and (3) the problem attitude. The *self-attentive attitude* is illustrated by him by this extract from a man's account of how he solved a puzzle.

"It seemed to me that if anybody had given it to me without saying that it was a puzzle (a bona fide one) I would have said it was impossible up to the last minute. I have a feeling now of loss of esteem. I had this all along because I couldn't do something which was made for people with ordinary brains to do. One conclusion that kept running through my mind all the time was that I had a subordinate mind. I couldn't help having a gleeful, self-satisfied feeling when it actually seemed to be coming off, although it was a surprise."

Individuals possessed with this self-attentive attitude express themselves as being afraid that the experimenter was getting bored because they were slow, or that he would think them extremely stupid, etc. The principal thing, then, that occupied the minds of people with this attitude was the concern as to their general fitness and as to what others would think of them.

The Suggestible Attitude.—Ruger says, "In two of the men there seemed to be a special sensitiveness towards any movements of the operator which might give an indication as to the course to be pursued. In such cases as this there is a lack of confidence in the self but the attention is directed not to the self but to some other person. The center of gravity, if one may so describe it, of the responsibility is located elsewhere and the suggestions, intentional or unintentional, of the other person or persons concerned are accepted uncritically. This tendency was noted by the writer in his own case in novel situations of a more distinctly social type, such as business transactions of an unaccustomed sort, or other similar cases where persons instead of things were to be dealt with and where the other person was felt to have superior information as to the matter in hand and the self to be deficient."

Probably all have experienced this attitude when attempting to do something new while in the presence of others. This is particularly true when those present are known to know more about the task than one's self. Their presence bothers us; very often we make mistakes that we know we would not make if we had been alone. Here our attention is directed as much, if not more, toward those who are present than to the work before us. And at such times we are especially susceptible to any indications from these persons as to whether we are doing well or poorly.

The Problem Attitude.—"In contradistinction to these two attitudes, which are certainly not favorable to efficiency," this third attitude is essentially an attitude of self-confidence. "The self-

confidence is not one of sluggish complacency, however, but is expressed in a high level of intellectual activity, of attention. Attention would be directed to the thing to be done rather than to appraisal of the self."

In experiment of the last lesson undoubtedly most individuals had somewhat of the self-attentive attitude, or the suggestible attitude, or both to start with. And as practise continued the earlier attitude faded out more and more and the problem attitude took its place. Occasionally an individual displays only the problem attitude throughout the practice period. And occasionally also an individual continues to show the self-attentive attitude throughout, but this is rather rare. Usually there is a noticeable change toward the adoption of the problem attitude.

Some of the factors that bring about this change in attitude are the realization that one is improving, that one can do the task, that another is doing it successfully, etc. But sometimes the latter factor reacts in just the opposite way.

Differences in Feeling.—For our purpose here in an elementary course we can think of feeling as either pleasant or unpleasant. If either become particularly strong then we have an emotion of joy or love on the one hand, or fear, hate, or anger on the other hand.

Now repeat the experiment of the nickels and cents with another person and note carefully all evidences of changes in attitude or feeling or emotion during the experiment. Determine as carefully as possible the relationship between successful or unsuccessful moves and feeling. Also note whether the person doing the puzzle changed his method or "mode of attack." If so, just how were these changes associated with changes in attitude or feeling?

Carefully consider the type of situation involved in this puzzle, or in learning signaling, or in fixing an auto engine with such other situations as writing up reports, or reading orders, or performing military manoeuvres after they have been learned. Explosive action is much more likely to occur with the former than the latter. Why?

From a practical standpoint, when we find a man losing his temper or acting in a sullen and defiant way what should we guess is the matter? How should we go to work to correct the trouble? Is disciplinary action the proper method to accomplish this?

What are the best steps to take to cure a capable man of self-consciousness and make him a good leader of men?

Write up your report discussing at length your conclusions on these points—particularly as to the practical applications affecting the relationship between officers and soldiers.

IV. *How Should a Command like "Squads Right" be Taught Recruits?*—Just how does one learn to execute "right shoulder arms" or to shoot a rifle accurately, or salute properly, or any of the many new movements involved in military training? An accurate analysis will show that there are really two fundamentally different methods.

With the first method one just stumbles about trying this and that and eventually after being corrected again and again finally succeeds in executing the movement satisfactorily. This procedure can be illustrated roughly in this way. Suppose P and Q, who are blindfolded, are standing in the middle of a recently harrowed field, or better still in a field covered with snow. P determines just to which part of the field he wants Q to go but he doesn't tell him: Q is to reach this point by keeping walking, changing his direction whenever P calls out "Change" and to keep going when P says nothing. Now when Q starts out he is as likely to go one way as another. The consequence is that he will start a number of times and because they are wrong P will so signal and Q will stop and start again. The snow all about the starting point will become all trampled because of these starts and stops. But presently Q will hit upon the correct direction, P will no longer signal to stop and Q will continue in the desired direction. If he walks in a straight line he will presently reach the desired point. If he doesn't P will signal to change and Q will then make a few stops and starts, finally hitting on the correct direction again. In this way Q will finally reach the desired point. He has reached it through starting many incorrect movements which were immediately checked and then continuing the correct movement whenever hit upon. Now suppose P and Q start over again. The process will be largely the same as before. But as it will be easier walking wherever Q has traveled before, Q will be much more likely to continue in old paths than to make new ones. And as the correct direction is the only one that continues for any distance Q will be aided by it much more than by the little short paths that lead in the wrong direction. Still on the second trial, Q's guidance will come essentially from P's signals. As P and Q keep up this stunt, the correct path will become better and better formed and Q will gradually come to rely on it more and more and to need P's signals less and less. After a certain number of trials it is likely that Q could traverse the distance with no mistakes, by utilizing the well-worn pathway as a guide instead of the signals of P.

Much of our learning is of this sort, called in psychology "trial and error" learning. It depends (*a*) upon the teacher correcting us when we go wrong and encouraging us to keep at it when we go right and (*b*) upon the development of pathways, which popularly we speak of as "habits." In some way or other not understood today, the repetition of a series of movements creates certain pathways in the brain so that nervous discharges flow more easily over them than over new pathways.

Such learning always results in decided fluctuations in the speed and accuracy of each execution. One moment the act is beautifully performed, the next it is wretchedly carried out. But if the teacher constantly corrects and encourages there is improvement from day to day. Good instruction in this connection, however, is about as fatiguing for the instructor as for the learner; and too many instructors cease too early in their efforts, this resulting in ragged performance on the part of their pupils. Observation in most camps of the great variety of ways in which the act of saluting is done indicates how little real attention has been given to this very simple performance by the instructor.

The second method of learning, as distinguished from "trial and error" learning, is based upon analysis. In executing "right shoulder arms," for example, there are a number of simple movements with each arm. If the instructor analyzes out exactly each movement and then calls upon the squad to make movement No. 1 and sees to it that all clearly comprehend it and make it, then does the same with movement No. 2, and so on to the end, he will succeed in teaching the entire performance much quicker and with greater accuracy. Here the learner first of all notes the specific movements to be made and second he learns the order in which they are to be made.

Learning through analysis differs from learning by trial and error in that in the first case we "spot" the successive steps and then do them, whereas in the second case we stumble around with our attention on getting the whole process finished and possibly never do get clearly in mind how we do it.

Successful teaching in the army or elsewhere is dependent upon a careful analysis of each step in the whole process, the presenting of one step at a time, and finally sufficient drill upon the whole process so that all the steps are welded into one smoothly executed act.

Assignments.—Work out in as definite and detailed a way as

possible just what one does when (1) he salutes a superior officer, (2) he "about faces," and (3) a squad executes "squads right."

V. *How do Individuals Differ in Their Learning?*—In preceding lessons we have seen that individuals differ in many respects. One of the most important ways, however, in which individuals differ has not yet been discussed, *i. e.*, how they differ in their rate of learning.

In Figure 1 is shown the learning curves of two 10-year-old girls in solving simple addition combination, such as, $\underline{3}, \underline{1}, \underline{4}$, etc. The first girl solved 10 such problems correctly in one minute on the first day and on the twentieth day solved 37 correctly. The second girl solved 5 on the first day and only 9 on the last day. These are two extreme cases, it is true, for the first girl was one of the brightest in the 4th Grade while the other was mentally defective and still in the 1st Grade. Nevertheless the curves illustrate what we find throughout life, *i. e.*, the brighter the child the faster he learns; the duller the child, the slower he learns.

Probably everyone will agree to the above statement. But many will go on to add that the slow learner remembers longer and better than the fast learner. The proverb, "Easy come, easy go" is often repeated in such connections. Modern psychology has demonstrated, however, that popular opinion is in this case incorrect, that the rapid learner, on the average retains what he learns much longer and more accurately than the slow learner. The following figures are typical.

NUMBER OF PROBLEMS SOLVED

	At Commencement of Practice	At End of 10 Practice Periods	Gain in Number of Problems
College students.....	59	76	17
4th grade children.....	19	30	11
Defective children.....	4	7	3

Stated in another way the data shows us that

College students excel 4th Grade children at the start by 40 problems.

" " " " " " " " end " 46 "

College students excel Defective children at the start by 55 problems.

" " " " " " " " end " 69 "

4th Grade children excel Defective children at the start by 15 problems.

" " " " " " " " end " 23 "

NUMBER OF PROBLEMS

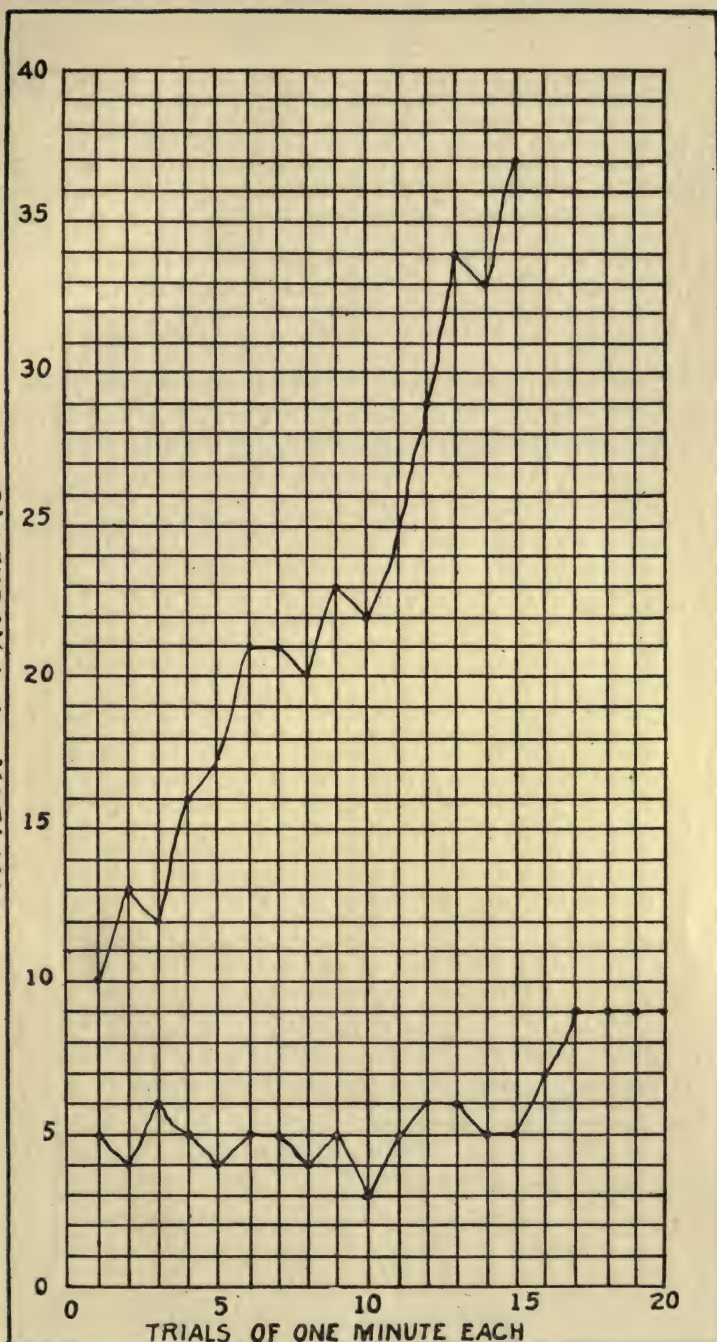


FIG. 1. Showing learning curve in solving addition combinations for a bright 4th grade child and mentally defective child of the same age. (In case of the latter between trials 10 and 11 there intervened 170 minutes of drill extending over 25 days on addition combinations.)

Of course, there are some rapid learners who don't spend enough time on their work really to learn it and who consequently very quickly forget and there are some slow learners who spend a great deal of extra time on their work and do remember it very well. But these are the exceptions to the rule. The brighter the individual the quicker he learns and because he is bright he also retains best. The duller the individual the slower he learns and just because he is dull he forgets quickly.

The psychological intelligence rating, discussed in Section II, is a fairly good measure of the rate at which one will learn a new thing. In consequence one should expect that rating A and B men will learn rapidly while rating D and E men will learn very slowly. The former will get in one or two lessons what the latter will only get in three or four, or even more lessons.

Another way of presenting these facts is this. Suppose A is bright and can get his lessons in two hours' study whereas B is not so bright and can get his lessons only after four hours' work. Now if both get each lesson as they go along, of course, they will both finish the course. If B, however, can only give three hours to his lesson, then he will get but three-fourths of the first lesson. In the case of the second lesson he will get less than three-fourths, for not knowing one-fourth of the first lesson will make it still harder to get the second. In a very short time he will be unable to get the lessons at all, even devoting three hours to them, because so much of what has gone before is unknown to him.

All of this actually happens in every college every year and in the army in Officer Training Schools and in company drill. The proper handling of such failures in most cases is to take them out of the group and give them separate instruction with a clear recognition that they will progress but at a slower rate than their brighter companions.

Assignment.—(1) Outline what use the psychological ratings can be put to in the training of a company of infantry. (2) What additional steps should be taken in order to secure as well balanced training as is possible for an infantry company? (3) What treatment should be accorded (a) an intelligent man who is sullen and slow in learning signaling? (b) an unintelligent man who is sullen and slow in learning signaling?

VI. *How can Forgetting and Fatigue be best Overcome?*—From the *New York Times* of about May first, 1914, is quoted the following editorial comment on an article by a superintendent of a Connecticut brass works which appeared in *The Iron Age*.

"At these works there was recently constructed a long incline up which heavy loads were to be wheeled in barrows, and premiums were offered to the men who did or exceeded a certain amount of this labor. They attempted it vigorously, but none succeeded in earning any of the extra money, instead they all fell considerably below the fixed task.

"Prompt investigation by an expert disclosed that the trouble lay in the fact that the men were working without sufficiently frequent periods of rest. Thereupon a foreman was stationed by a clock, and every twelve minutes he blew a whistle. At the sound every barrowman stopped where he was, sat down on his barrow, and rested for three minutes. The first hour after that was done showed a remarkable change for the better in accomplishment; the second day the men all made the premium allowance by doing more than what had been too much; and on the third day the minimum compensation had arisen, on the average, 40 per cent., with no complaints of overdriving from any of the force."

Apparently a man can do more physical labor by working 12 minutes and resting 3 minutes out of every 15 than he can if he works all of every 15-minute period throughout the day. This principle is one of the fundamental principles underlying scientific management, which has been so much discussed of late in various publications.

This statement raises an important issue: how shall an officer distribute his time in drilling his soldiers so that they will learn most rapidly. Certain factors enter into such a problem: (1) the laws of learning; (2) the laws of forgetting; (3) the laws of fatigue; and (4) the effect of rest periods upon learning and fatigue.

The laws of learning have been already presented sufficiently for our purpose here. One learns rapidly at first and then more and more slowly; one fluctuates from moment to moment as regards accuracy and speed of performance; one learns in proportion to one's intelligence; etc.

The principal law of forgetting is that what we have learned is always being erased from our minds and that we forget most of a new lesson very quickly and the remainder more and more slowly. In consequence, each day before we can start to learn new things we must re-learn what we learned yesterday but have since forgotten. This relearning is spoken of as "warming up." All engaged in athletics know how important warming up is before one enters a contest. We don't appreciate the fact so much in the more purely

intellectual realm, but the law holds good just the same. One hour spent on a lesson during the evening and reviewed for fifteen minutes in the morning will be recited upon much better than if an hour and a quarter is spent upon it at night. And if a company was quietly and slowly put through all the movements which it has recently learned during the first few minutes of drill in the morning, much greater progress would be made with far less confusion. For it is useless to expect a company to drill the first thing in the morning as well as it did the preceding day.

The principal law of fatigue is that theoretically we commence to fatigue as soon as we start working, but practically we do not commence to slow up or do poorer work until after working some time. The difference is due to the fact that for sometime we shift the work from one set of muscles to another thereby resting them in turn and only after they are considerably fatigued does the performance actually show a diminution in work done.

With these facts before us we are ready to consider situations such as presented in the illustration taken from the *Iron Age*.

Professor Starch had four groups of individuals employed in a

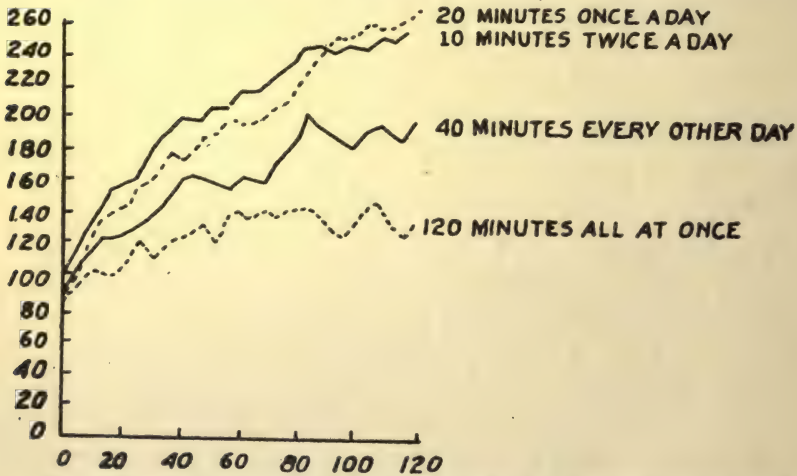


FIG. 2. Showing improvement in writing numbers for letters, according as the total time of 120 minutes is distributed in four different ways. Based on work of Starch.

substitution test for a period of 120 minutes each. (A substitution test is similar to the process of transcribing a letter into a secret code.) The first group worked 10 minutes at a time, twice

a day for 6 days; the second group 20 minutes at a time once a day for 6 days; the third group 40 minutes on alternate days and the fourth group worked 120 minutes at a stretch. From Figure 2, it is apparent that the first group accomplished the most, with the second group a close second. Both groups accomplished considerably more than the other two groups.

The writer drilled a fourth grade two minutes a day in addition and multiplication each day for 14 days and found the following average number of simple problems done on the 14 days,—the prob-

O 12

lems consisting of the combinations from 1 to 12.

	<i>Addition</i>	<i>Multiplication</i>
1st	38 problems done correctly	22 problems done correctly
14th	66 " " "	55 " " "

No one could duplicate such rapid improvement if they spent 28 minutes on either addition or multiplication all on one day.

As a general answer to the problem set us in this lesson, we can say that *distributed learning, i. e., learning periods interspersed with rest periods, is superior to concentrated learning.* Ordinarily the difference between the two methods is considerable.

These examples illustrate the effect of rest periods in learning. There is no evidence, of which the writer is aware, that such distributed periods are superior to steady work when the individual is *working* as distinguished from *learning*, up to the point where fatigue commences to be manifested. Work involving fatigue can,

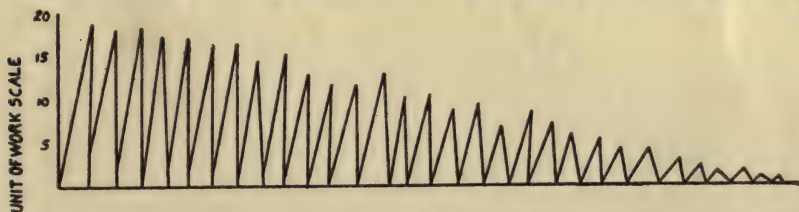


FIG. 3. Showing fatigue from work. The height of the successive lines shows the amount of work done with each contraction.

on the other hand, undoubtedly be facilitated by distributing the work periods, *i. e.*, by distributing work and rest periods throughout the day. One example of this has been presented at the beginning of the lesson.

Maggiore has shown that if 30 contractions exhaust a muscle so that it needs 2 hours rest in order to do equally efficient work

again, 15 contractions will require not 1 hour's rest but only $\frac{1}{2}$ hour's rest for recuperation. The second 15 contractions exhaust the muscles, then, very much more than did the first 15 contractions. At the same time the amount of work accomplished by the last 15 contractions is much less (as can be seen from Figure 3) than that accomplished by the first 15 contractions. Roughly to illustrate this, suppose the first contraction does 20 units of work, the 15th contraction 10 units and the 30th contraction 0 units. Then the first 15 contractions would do $(20 + 10 \times 15)/2$, *i. e.*, 225 units of work and the last 15 contractions would do $(10 + 0 \times 15)/2$, *i. e.*, 75 units of work. Now if A should do 15 contractions and then rest 30 minutes alternately for 8 hours, he could do (16×225) , *i. e.*, 3,600 units of work, whereas, B who did 30 contractions and then had to stop for 2 hours in order to be rested—could do $(4 \times (225 + 75))$, *i. e.*, 1,200 units of work. A so worked that he never became particularly fatigued and he only worked while he was doing efficient work (*i. e.*, the first 15 contractions). B, on the other hand, kept working until exhausted and then had to rest a long time. By so working he also did inefficient work (*i. e.*, the last 15 contractions).

Work can be explained as resulting from chemical changes causing movements of the muscles. Glycogen ($C_6H_{10}O_5$), the form in which digested sugar is stored in the body, disappears. And carbon dioxide (CO_2), lactic acid ($C_3H_6O_3$), and acid potassium phosphate (KH_2PO_4) are liberated. Continued excessive work results in the glycogen being used up faster than it can be brought to the working muscles by the blood. Also, the waste products accumulate in the muscles instead of being carried away by the blood. A rest period provides an opportunity for needed glycogen to be brought to the muscles and the waste products removed.

With all these facts before us it is clear that the alternation of work and rest periods secures to the worker his maximum output since his muscles never become clogged with poisonous waste products and they always are supplied with sufficient glycogen. The proper ratio of work and rest will depend, of course, on the type of work to be done. Excessively hard work will require relatively more frequent and longer rest periods than more moderate work. In cases of light work, it has been found advantageous to have the workers work at top speed for short intervals and then rest, advantageous from the standpoint of work accomplished and interest and lack of fatigue on the part of the worker. Most individuals

become more wearied by the monotony of an easy task than by the work itself. Frequent rest periods break up this feeling of ennui, especially when during the working period the work is done at such a rate as to demand one's full attention.

Assignment. (1) What is the effect of cramming? (2) What happens when a company is drilled too hard? (3) What is the most efficient manner of studying? (4) What Army regulations provide for the interspersing of rest periods in drill and in marching?

GENERAL REVIEWS AND SUMMARIES

REACTION TIME

BY V. A. C. HENMON

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Cassel and Dallenbach (1) studied the effect of continuous (an electrically driven tuning fork), intermittent (electric bell), and continuous-intermittent (metronome) auditory distractions upon sensory reactions to auditory stimuli (noise produced by the Wundt sound-hammer). The lengthening of reaction times under distractions on the average is smallest in the case of continuous distraction and largest in the case of intermittent distraction, which leads to the conclusion "that the 'inhibiting' effect of a distraction varies with its duration and regularity." A detailed analysis of the data, however, shows the effect of the distractors is not uniform, it may inhibit or may facilitate the reaction or it may become habitual and have no effect at all. The effect of the distraction is dependent not only upon the temporal relations of the distractor but also upon the conscious attitude of the observer during the distraction. To neglect of standardizing the observer's attitude is attributable the lack of agreement among previous investigators.

May (4) studied the processes involved in the fore-period, main-period, and after-period of the controlled associative reaction with special reference to the analysis of the fore-period. The hypothesis on which the study proceeds is that the significant thing in controlled association is not what takes place between the stimulus and the response, that is, in the main-period, but what takes place just before the stimulus is given, that is, in the fore-period. Introspective observations and time measurements were taken with stimuli requiring the subject to give (1) opposites, (2) whole-parts, (3) part-wholes, (4) subordinates and (5) verb-objects, with variations in times of the fore-period of .88, .50, .35, .15 and no seconds. The time measurements centered about the relation between the length of the fore-period and the length of the main-period. The results show that complete preparatory set shortens the association time from about 10 to 25 per cent. The total time of the entire

performance is shortest, however, when the preparatory set is at its minimum.

Richmond (5) urges the use of the reaction key suspended as a pendulum instead of on a spring and employing the opposition of the thumb and fingers in producing the reaction movement. The key is closed by placing the finger on the button and the thumb on the base. By simply opening the thumb and finger the key is released. The horizontal motion makes this use of the key better than the Dessoir key as modified by Scripture. The suspended key, it is claimed, reduces the number of muscles used in making the response movement to the fewest possible, and apparently eliminates the antagonistic reactions.

Klopsteg (3) describes a chronoscope which consists of a galvanometer with a direct reading scale, corresponding to the intervals during which a steady current is permitted to flow through the instrument. "The calibration of the scale depends upon the known relation between the total quantity of electricity which has passed through the galvanometer during a given time interval, and the length of this interval. As a means of adjustment and control of the scale readings, a new fall apparatus is described which accurately "measures out" to the chronoscope any time interval within the range of the latter." The advantages of the chronoscope are simplicity and ease of manipulation, great accuracy, absolute silence during operation, automatic return of indicator to zero reading, and hence rapidity of operation.

Claparède (2) describes an apparatus constructed by M. Dégalier which may be used as a chronoscope, as a chronograph, as an electric counter, or to give periodic signals. The chronoscope is light and portable, measures very accurately to hundredths of seconds, and according to Claparède has many advantages over the D'Arsonval or Hipp chronoscopes. The manufacturers are Les Fabriques des Montres Zènith, au Locle, Neuchâtel, Switzerland.

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LEARNING

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A detailed and forceful criticism of the accepted normal learning curve is made by Peterson (7). This criticism is the result both of a rearrangement of data that have been furnished in the past by Bryan and Harter, Swift, etc., and of experiments in ball tossing conducted by the writer. Peterson believes that erroneous conclusions regarding the learning curve have been accepted because of failure on the part of investigators to study the significance of the data upon which the curve is usually based; particularly the failure to distinguish between (a) curves of average attainment, or accomplishment curves and (b) time, error or excess distance curves—the ones usually plotted by investigators. This specific failure has led to unwarranted comparisons between these two curve types. The author's first and chief contention is concerned with the rapid initial slope commonly described. Little evidence exists, so far as ball tossing is concerned, for the current view that learning is more rapid in its initial stage; in fact, the evidence for this phenomenon in most learning activities is of doubtful value. The reciprocal relationship existing between the attainment curve and the error curve is the explanation for the misleading inferences made. It is such that the error curve must drop comparatively very rapidly at first while the attainment curve changes very slowly; and the error curve must drop very slowly later while the attainment curve rises rapidly. These changes do not indicate corresponding changes in the learning. The second criticism is directed at the usual discussion of the plateau and the approach to the physiological limit. Whether or not a plateau appears depends upon the type of curve chosen to represent the learning process. If it comes late in the learning, it may be covered up in the time or error curve; and this may be one reason why time and error curves frequently fail to show plateaus. A third point is the distinction between motor learning and sensory discrimination learning. The latter is characterized by the absence of the initial slope and plateaus. A proper conversion of the data would show little grounds for the distinction—i. e., the true motor learning curve would approximate the sensory discrimination curve. In addition to the critical discussion of the learning curve, several conclusions are offered regarding some of

the difficulties involved in the study of learning. Practice in the early part differs so much from practice in the later part that comparisons can scarcely be made. The skilled juggler during a ten-minute practice and the beginner during an equal time practice actually are engaged with separate problems.

An experimental contribution to the curve of mental work is made by Starch and Ash (8). A distinction should be made between the method involving tests or measurements at the beginning or end of periods of work (or at intervals during the work) and the method of investigating the progress of the work itself. In the first, the plan is to eliminate such factors as practice, warming up, etc. In the second, these factors are accounted for and evaluated. The present investigators followed the second procedure, using mental computation as the function to be studied. The subject was given a number consisting of two digits, and was instructed to add mentally six to this number, then seven to the sum, then eight and nine in order to the cumulated sums; he was then to return to six, add it to the sum last obtained, and continue this process in rotation, announcing his results orally. At the end of each thirty second interval the experimenter announced a new starting number. Twenty-three subjects were used. The length of the periods varied from thirty minutes to two hours and a half. This technique was employed for several reasons: it reduced sensory and physical factors to a minimum, it was continuous and homogeneous work and it taxed mental effort to its fullest extent. A record was kept of the amount and accuracy of the work accomplished. The results show that the maximum speed is attained by the end of the first twenty-five or thirty-five minutes and that during this period the improvement is gradual. This maximum speed is maintained during another thirty or thirty-five minutes. From the end of this stage the number of additions per unit of time begins to decrease gradually and continues to do so until the end of the period. Irregularity is most pronounced when the rate of addition is highest. In order to determine the full significance of this fact, the experimenters divided the data into two groups. Records averaging more than twelve additions for each half minute were put into Group I; records below that number, into Group II. This brought out the additional facts that those who work rapidly are more accurate; and, that a longer time is required to make an incorrect addition than a correct one, irrespective of the general speed of the worker. Conclusions regarding the analysis and function of mental fatigue are suggested

by the data. It was found that there are fewer errors at the close of the period of work than at the beginning. Mental fatigue is in one respect comparable with physical fatigue: as a muscle becomes fatigued, resistance develops in the nerve tract leading to it and the resistance protects the muscle from complete exhaustion. At the beginning of mental work the mind is alert and ready to respond to suggestions, extraneous and otherwise; towards the close of an extended period of mental work it becomes insulated to impressions and intrusions. In mental addition the associations called for are old and well formed. They persevere during fatigue while more recent associations tend to become eliminated. Hence the greater efficiency after a certain duration of practice. However, when an error finally does occur, it is followed by several others, and this tendency increases as the work is continued in its final stage.

A study made by Chapman on the effect of rapid changes of work on the rate of performance is of interest, especially when compared with the article just reviewed (2). Chapman's problem was to study the effect of rapid changes of work (*a*) when only one operation was performed and (*b*) when two operations were performed alternately. The efficiency of a group of subjects was tested during five different periods. In each of these periods the work was divided into six trials, each in turn of three minutes. During each of the three minute trials the work was interrupted every half minute, resulting (*a*) either in one kind of work, halted every half minute but immediately resumed or (*b*) alternate half minutes of two different kinds of work. The two types of work were addition and cancellation. The Thorndike addition and the Woodworth-Wells cancellation blanks were employed. When the work was alternated, the subject was given a blank containing the two sets of work on the two sides of the sheet; when the work was of the same kind, the sheet contained the same type of material on both sides, but the subject reversed his paper at the stated times. As the result of this experiment it was found that addition is fourteen per cent. more efficient when it is alternated with cancellation, but in the cancellation operation the effect of the change of work is negligible. This phenomenon can not be explained in terms of interest. It is probably a matter of interference. Cancellation is chiefly a motor test, and in the case of continuous performance the previous cancellations do not require time in order to fade away. Little has to be banished from the mind when the subject proceeds to the next cancellation. In contrast with this, addition is primarily a mental function.

When a transition is made from one problem to another all previous results, except the one necessary for the immediate calculation, must be forgotten. An individual with no figures in his mind can go faster; time therefore must be given for previous figures to fade out. In an extension of the experiment, half minute periods of rest were alternated with similar periods of addition. The increase in efficiency was found to be even stronger—twenty-one per cent. The conclusion reached by Chapman is in harmony with the results of an investigation previously conducted by him. Initial spurt is a negative term. It is due to lack of interference from antecedent mental work, rather than to a greater initial effort.

Two articles by Pechstein deal with the problem of the whole vs. the part method in motor learning. The first and major one (5) is a comparative study, giving the results of a extensive investigation of the maze learning behavior of the white rat and human. The problem is introduced by a concise statement of investigations previously made by various writers. Investigations have been limited to logical and rote material; they have been concerned with whole and part methods, but with no modification of either. Moreover, of the several explanations offered for the waste in part learning, none have been tested under controlled conditions. Pechstein's complete program was (a) to determine whether whole and part results in logical and rote learning hold for sensory-motor adaptive situations (b) to determine whether these laws hold for animals as well as for humans (c) to determine what factors operate for economy or waste in these methods (d) to devise new methods superior to either the whole or the part method (e) to apply the results to the school child. An ingenious maze was constructed for the white rat. It contained removable panels so arranged that the four sectors in the maze could be learned in any order. These four sectors were made equal as regards the number of possible errors and the length of the true path. A second maze was designed as a check upon one phase of the problem. Two corresponding pencil mazes for humans were employed. The results of the first part of the investigation indicate that the whole method brings final success with fewer trials than the part method, for both rats and humans, but with a greater percentage of gains for the humans. But while rats save time and errors by the part method, humans do not. The explanation is to be found in the retracing; that is, in the tendency to score errors while going towards the entrance. If these were eliminated from the records, the whole method would prove superior for both rats

and humans in every respect. Pechstein's second specific problem was the investigation of the retracings. Since these could not be entirely eliminated, he prevented a return into any of the four units of the maze after the preceding unit had been traversed. It was found that for both humans and animals the prevention of the returns increases the number of trials necessary for complete mastery, but with an enormous saving of time and errors. This discovery led to a discussion of the elements of waste in part learning. Five possible explanations have been proven to be unsound: (a) the loss in the part method is not due to negative transfer, since the evidence establishes the fact of positive transfer—learning one unit is favorable for the mastery of a subsequent unit. (b) The second hypothesis, that the loss is due to disintegration through time, is rejected on the experimental evidence. (c) No retroactive inhibition is exerted upon motor habits by the learning of subsequent ones. (d) The explanation of contiguity of unit functioning does not suffice for the loss in the part method. No new sequence of the four units (traversed as units) in the maze results in an appreciable loss. The part learner has absolute control over all of the units he has mastered, provided that these are kept as units. (e) A final explanation, that of unit incompatibility in a larger series, is likewise not supported by facts. A motor unit can function as such when it is part of a larger whole, and no incompatibility between specific parts exists in a motor problem. The hypothesis that does account successfully for the waste in part learning is that of place associations. Place association is the referring of an element in a problem to the entire problem. Thus, in rote learning a given syllable is learned with reference to the entire antecedent and subsequent terms. The maze learner relates a certain time span, distance and path sequence with a change in activity, such as feeding, in the case of the rats. In the part method the learner attacks his problem with the expectation of having it solved when certain time, distance and path sequence demands have been satisfied. The readjustment necessary in combining new units, as shown by the behavior in the act of connection, explains the loss in part method learning. However, it must not be inferred that the whole method is the efficient alternative, since modified part methods are superior to the pure whole method, as well as to the pure part method. In addition to the above conclusions, several others were supported by a continuation of the experiments. Transfer factors, both general and specific, operate at their full value in the part method. The

law of diminishing returns holds in a maze of excessive length and difficulty; and the part methods aid in compensating for this factor. As regards the distribution of learning it was found that massing trials is highly unfavorable for the whole method; but all types of part method learning produced better results under massed conditions than whole methods under similar massed conditions. Finally, it was ascertained that learning a motor problem by the part method produces results that contradict the findings secured under similar conditions with rote and logical material. A second article by Pechstein (6) expresses in more concise form the conclusions reached by him as the result of this investigation.

The maze was used by Webb (9) as an experimental device for a comparative study of transfer and retroaction. The possibilities in the meaning of the two terms are defined in his preliminary statement; both of them may refer to positive or to negative effects, or to the absence of effect. Webb's first procedure was to divide his subjects, who had learned a maze (Maze A) into groups. One group was then asked to learn Maze B; another Maze C; and a third, Maze D. A similar program was put into effect with the rats. The results show transfer for all mazes for both humans and animals; moreover, this transfer was in evidence in all of the three measurements—error, time and excess distance. This is all the more significant inasmuch as Mazes A and B were designed to secure transfer effects, while the others were constructed to elicit negative transfer. While the net results were positive, negative effects were in evidence—transfer is a composite process, and the total result is determined by the predominance of one of the two elements. A third group of results deal with the degree of transfer. It is partly a function of the second learning activity, since the second problem varied with each group while the first (Maze A) was fairly constant. The activity acquired in the first problem also determines to an extent the degree of transfer, since the amounts saved in the second problem and the original learning records were roughly proportional. Again, transfer depends upon the amount of similarity in two mazes. The laws and conditions of transfer are essentially identical for both humans and the rats. The locus of transfer is on the average confined to the first five trials—the subjects saved in the second problem the equivalent of the first five trials of effort. Transfer operates more by reducing the tendency to retrace than by decreasing the tendency to enter cul-de-sacs. These results lead to a criticism of the transfer theories of both

Bagley and Thorndike; the maze learning activity, however, is too complex to afford an easy technique for an analysis of this phenomenon. The second part of Webb's experiment is devoted to a study of retroaction. More individual variation is in evidence in relearning a maze than in its original mastery. No correlation obtains between the learning and the relearning records. Humans show a slightly greater retentive ability in the maze activity than rats. The maze requiring the greater effort in learning is retained better than a maze calling for a lesser degree of effort. The results also show negative retroaction (retroactive inhibition). This is an individual matter, not a function of the maze itself. Humans are more likely to show retroactive effects than animals. A positive correlation exists between any two of the three criteria employed in measuring retroaction. A positive correlation holds between ease in learning a maze and the negative amount of retroactive influence, and a negative correlation between positive transfer and a negative retroaction. Two theories are suggested in explanation of retroaction. According to the Transfer Hypothesis, in a sequence of mazes learned, A-B-C, the effect is in terms of the transfer of the B habit to the relearning of A. According to the Disruption Hypothesis the B habit disrupts and disorganizes the relearning, or the second A habit. While the two are not necessarily antagonistic, the explanation is to be found chiefly in terms of transfer.

A comparison between two methods of learning the same material is made by Gray (3). The material used was an ingenious form of the substitution test. The subjects were required to translate twelve prose selections into code form. These selections were printed on the left margin of the sheet. The remainder of the sheet contained intersecting vertical and horizontal lines, the latter corresponding to the lines of the selection. The subject marked on each vertical line in order from left to right the symbols representing the letters of the printed line by a series of short dashes to the right and to the left of the vertical. The key consisted of the letters of the alphabet and corresponding numbers composed of the digits 1 and 2. The 1 meant a dash to left of the vertical line, and the 2, a dash to the right. The order in which the digits were given indicated the order in which the dashes were to be placed, from the top of the section of the vertical line to the bottom. Thus, R, 2111, was expressed by one dash to the right followed beneath by three to the left. The number combinations were made according to a definite, logical system. The test was given to two groups by two

different methods. In Method I the letters of the alphabet with their code numbers were printed at the top of the sheet; but they were arranged in irregular order, and the plan was not discovered by the subject. In Method II the plan was carefully explained, thus making the test a rational procedure. The results show that the upper limits of distribution, or the highest point in efficiency, was attained by individuals using each of the methods. However, the rational method makes for a wider range of distribution than the mechanical. The rational method also requires a greater initial period of adjustment before objective progress is in evidence, and this for some is a period of discouragement. As a check upon the interpretation of the results, three tests were given to individuals in both groups. These were the Thorndike Association Test, the span of attention and the tapping test. A good correlation was obtained between ability in the association test and in the original substitution test; but this correlation, though positive, was not so pronounced in the two remaining tests. In order to determine the importance of the motor aspects of the substitution test, forty subjects were given a series of tests in making horizontal marks on alternate sides of a vertical line. The correlations indicate that a considerable part of the learning is a motor function. An analysis of the error record in the substitution test shows that in the earlier part of the learning more errors were made by those employing the logical method than by those using the mechanical method; but the two methods produce about equal records in accuracy towards the end of the practice. Since the logical method required more mental work and resulted in more discouragement, the question of a compensatory effect for this method was investigated. Three devices for testing retention were employed, and it was found that the logical method results in a far greater amount of retention, presumably because it requires work of a higher mental level. The question of transfer was next investigated. Two substitution tests devised by Dearborn and Goddard were used for this purpose. The training resulting from the logical method permits greater transfer than a similar amount of practice with the mechanical method. In interpreting this fact in the light of different theories of transfer, Thorndike's theory of identical elements is inadequate because an equal number of common points is present in both cases. Bagley's theory of ideals is also unsatisfactory. Angell's theory of attention is more plausible, since a far greater premium was placed upon the attentive factor in Method II than in Method I. This,

combined with Judd's theory of generalization, seems best to explain the transfer effects found.

A comparison between normal and feeble-minded children as regards their ability in practice and transfer is reported by Woodrow, in two articles, (10, 11). Four groups were used, a normal practice and a control group of the two types of children respectively. The mental age of nine was the basis for the selection. The chronological age of the normal children was accepted as adequate for that group. The chronological age of the feeble-minded was slightly under fourteen. Practice consisted in sorting out the geometrical designs furnished by the Woodworth-Wells Substitution Test. These were pasted on gun wads and the wads were sorted into appropriate boxes. The number sorted per unit of time was used in determining the scores. It was found that the practice curves for both feeble-minded and normal children of the same mental ages are strictly comparable. Feeble-minded children show the same improvement with practice as the normal children. In both groups those ranking low in initial ability improve relatively more than those ranking high; in absolute terms, children of both groups improve to about the same extent. Feeble-minded children show a slightly greater tendency towards irregularity, but the difference is less than the probable error of the difference, and therefore is not of consequence. The assumption that feeble-minded children are not capable of improving with practice to the extent that normal children of the same mental age is made because of the erroneous tendency to identify capacity for mental development with ability to gain with practice. It is not inability to learn that characterizes incapacity for mental development, but inability to grow. The experiment was continued for the purpose of determining the effects of transfer. The tests used were sorting sticks of varying lengths, sorting colored pegs, a letter and a form cancellation test. The instructions emphasized speed. A comparison of the transfer effects was made by repeating these tests with the control groups after an interval of time. Again the results indicate great individual differences in improvability for each group but no difference of significance between the two groups as regards transfer. The general conclusions suggested by the first part of the experiment are confirmed by the part dealing with transfer. Feeble-minded children, averaging in age fourteen chronologically and nine mentally, may be regarded as arrested in mental growth. Normal children of the same chronological and mental age in all

likelihood will continue to grow mentally. It is not inferior ability to learn that keeps the feeble-minded children from becoming normal. The possibility of lack of retentive ability is suggested, but the difference in memory between feeble-minded and normal children does not justify the acceptance of this explanation. The results of the experiment do not answer the question in positive terms. Absence of capacity for growth seems to be the distinguishing factor between the normal and the feeble-minded child.

Myers (4) reports the results of an investigation of correlations in learning. These are concerned with the relationship between initial and subsequent performance, the tendency of practice to bring individuals more closely together or to separate them, the relationship between card sorting and intelligence and improvement in card sorting as an index of intelligence. In card sorting, the individuals tend to maintain the same relative position during the learning. Stated in more concise terms, the first five trials are representative of their learning processes. However, factors in addition to capacity for the task enter into the learning. The subjects who were informed of the differences in the rate of progress of the various learners manifested a greater tendency to shift than those who were not so informed. As regards the relationship between card sorting and intelligence, no correlation obtains; but gain in card sorting shows a positive correlation with intelligence. This supports the tendency to define intelligence in terms of capacity for improvement. On the basis of other correlations the author concludes that the performers who attain the highest place tend to gain most, and that the performers who reach the highest point tend to end best. The question of the tendency of practice to make individuals in the group more homogeneous cannot be answered in either positive or negative terms. Finally, no correlation holds between irregularity and gain in performance.

Thurston's method of calculating learning curve coefficients is criticized in a short article by Blair (1). The claim is made that the equation breaks down in use because of no known method of estimating the zero point. This would result in a child with n amounts of practice being credited with less previous practice than the child with o practice. Furthermore, since there are differences in the rate of learning it is impossible to compare a segment of one curve with a segment of another. The true zero point in learning must be discovered before any learning curve equation can be employed.

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THOUGHT AND THE HIGHER MENTAL PROCESSES

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Continuing a study, reported several years ago, which shows that good visualizers do not differ appreciably from poor visualizers in the accuracy of their judgments of numbers or magnitudes from memory, Thorndike (5) investigated the question of whether the same holds good when the judgments are of *relative* magnitude or proportion. About 300 students were asked to judge from memory what per cent. the length of a certain building is of the total width of the square on which it stands. The errors made by the poorest third of the visualizers were only slightly in excess of those made by the best third.

In multiplying mentally three place by two place numbers, the best visualizers made a median time of 480 seconds with 5 as the median number of mistakes. The corresponding numbers for the poor visualizers were 500 and 6.

Basing his conclusion on a coefficient of correlation, Thorndike

found that ten reports of visualization will give practically as good a result as an infinite number of reports.

Parsons (3) found no marked difference between the imaginative reaction of children (52 boys and 45 girls aged 7-7 1/2) and adults toward ten standardized ink-blots. Children, like adults, are most interested in animals and other living things. Boys of seven are more interested in war than girls of the same age, while girls seem to have a keener interest in domestic animals. There is a marked preponderance of nonconstructive associations, as "lady dancing," "a broken sledge." A tendency toward active imagination is indicated by a frequent active search for associations.

Using simple drawings of circles, triangles and straight lines with the hand out of sight, accompanied by introspective records, and with four psychologists as subjects, Metcalf (2) attempted to ascertain whether certain regular bodily reactions accompany the attitude of certainty and uncertainty. He found that there is a correlation between the conscious attitudes and the objective form of the reaction as measured by its accuracy, rate and pressure. Accuracy of the drawing is less important than the other characteristics for the appearance of certainty; in some cases greater accuracy and certainty go together, but more frequently they do not. In relation to the time element, certainty is usually found with a faster, and especially an accelerated, rate of drawing. In most cases, also, certainty is found to be correlated with a definite type of pressure curve, and uncertainty with a deviation from that type.

Restricting himself to the sense of touch, Bonaventura (1) reports an experimental investigation on thought activity in sensorial perception. Little, if anything, beyond the well known associative processes active in perception, is revealed. Space perception by touch is said to be the result of the elaboration of sensations by thought, which takes note of certain characteristics, distinguishes them and places them in certain relations, one to another. These are associated with relations of space derived from muscular and articular sensations connected with motions and with sensations from sight.

Under the title "How far can ideas influence peripheral processes?" Solomon (4) discusses the possible peripheral changes producible by hypnotism, presenting the best authentic evidence for and against bodily or peripheral effects of hypnotism. He emphasizes the necessity of clearcut differentiation between the

ideational processes and those of emotional origin, concluding that much of the claimed production of peripheral sensory effects by hypnotic influence is due to a confusion of the ideogenetic and emotogenetic processes. He next discusses the claims made in psychopathology, concluding that many of the claims of peripheral effects are not valid, but are due to a disordered functioning of the involuntary and voluntary nervous systems. Among the conclusions he comes to are: ideas can lead to functioning of the voluntary nervous system but cannot, in a direct manner, produce activity of a sensory nature. Hence, hallucinations of any kind cannot be due directly to ideas. Ideas cannot directly produce, or call into being, pains of a true type. Ideas cannot directly affect the peripheral processes wholly under the domination of the involuntary nervous system, although they can indirectly affect the involuntary system by exciting the emotions.

Whitehead's (6) *The Organization of Thought* is pedagogical rather than psychological in its nature. The book takes its title from one of a series of eight relatively independent papers and addresses. Organized thought is made to be synonymous with science and is recognized as the basis of organized action. Science is rooted in common sense thought: this is the *datum* from which it starts and to which it must recur. Formal, traditional logic is criticised, but "logic properly used, does not shackle thought. It gives freedom, and above all, boldness." The induction of valid generalizations should be made the keystone of logic and to this deduction should be in the main tributary.

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NOTES AND NEWS

THE Summer Training School of Psychiatric Social Work conducted by the Boston Psychopathic Hospital and Smith College under the auspices of the National Committee for Mental Hygiene opened at Smith College July 7th with an enrollment of 68 young women from 21 states and as many colleges. The purpose of the school was to give in eight weeks the theoretical background necessary to prepare social workers to assist in the rehabilitation of soldiers suffering from "shell shock" and other nervous and mental disorders.

THE temporary officers of the American Association of Clinical Psychologists have deemed it advisable to cancel the annual meeting scheduled for December, 1918. The temporary officers of the Association are as follows: Chairman, J. E. Wallace Wallin. Secretary: Leta S. Hollingworth. Committee on constitution: Leta S. Hollingworth, David Mitchell and Francis N. Maxfield. Committee on nomination of officers and new members: Rudolf Pintner, Helen Thompson Woolley and H. H. Goddard. Committee on program for the next meeting: the chairman, secretary and the committee on constitution. (Later: The action of the officers has been rescinded, and it has been decided to hold an informal meeting at Baltimore at the time of, or following, the meeting of the American Psychological Association.)

JOSEPH PETERSON (Ph.D., Chicago, 1907), assistant professor of psychology in the University of Minnesota and chairman of the department for 1918-1919, has resigned to accept a professorship of psychology in George Peabody College for Teachers, Nashville, Tenn.

THE Council of the American Psychological Association has decided to hold the regular meeting of the Association in Baltimore during the Christmas holidays. The papers to be presented will deal largely with the relations of psychology to Army activities.

THE PSYCHOLOGICAL BULLETIN

MORALE IN WAR AND AFTER¹

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Introduction.—One of the best culture results of the war has been to make all intelligent people think and talk much about morale. There is already an interesting, valuable, and rapidly growing literature about it. Now that the war is over, the interest which was growing so rapidly in army morale is being transferred to civil life, and we are coming into a new appreciation of its value

¹ Prepared, in conjunction with other articles, for the S. A. T. C.

and meaning in that domain, and are hearing of personal, family, community, city, party, business, institutional, and national morale. Thus the war has given us a new sense of the value of this intangible, spiritual virtue, which, in a word, means manliness. There is a sense in which the army, like all other human institutions, is a state of mind. Its morale is its soul (*Mens agitat molem*) without which masses of men and munitions make only a blind titan Polyphemus.

What is morale? No two conceptions of it are alike. It can no more be defined than energy, or life, or soul. All we can do is to try to describe, to feel, and to guide it. We can already see that it has very deep roots; its ultimate source is nothing less than the great evolutionary urge itself. Of this it is, as we are now conceiving it, about the latest and highest product. It bottoms on Schopenhauer's will to live, Bergson's *élan vital*, Jung's *horme*, or nothing less than the evolutionary nisus itself. As Carruth said, "Some call it" evolution, "And others call it God." When and where it is strongest it makes the individual feel "fit" for any task. It also gives him a sense of solidarity with his comrades seeking the same end, and enables him either to do or to suffer in a common cause. To some extent it ebbs and flows by causes within which we cannot control or even fully understand. Yet to a great extent it can, like condition in an athlete, be trained for and cultivated. To do this latter for morale in every field is one of the great demands which modern civilization is now laying upon itself, in far greater degree than ever before. For this reason it is of fundamental importance for those who would fully enter into the life of the dawning post-bellum epoch to very carefully weigh its importance and learn all that can be taught, and to seek from every source all the practical insight available to keep it at its best in ourselves, in those nearest to us, and in every institution with which we are connected. All, especially every young man and woman, wish to be, to do something in the world that is worth while. In proportion to the momentum of life which they inherit they feel the impulse of the youth in Longfellow's "Excelsior" to climb ever higher, to gain influence, power, possession, to overcome obstacles, and to make the most and best of themselves. This vital energy keeps up a constant pressure upon reality about them to subdue it and mold it to their will, as man has always sought to dominate Nature and circumstance.

But when morale sags or fails of attaining this goal, then the

tide ebbs and the individual turns away and perhaps flees from reality, loses heart, courage, and becomes a coward to life. He is unable to face the here and now, evades, and becomes a slacker, and if this abandonment of the life impulse goes too far it may bring him face to face with suicide, which is the acme of recreancy. Thus there is a sense in which life is everywhere and always a battle, in which the presence or absence of morale determines success or failure, for there is always repression to be overcome.

Let us first, then, consider morale in war, and then attempt to apply some of its lessons to the conditions of peace.

Perhaps the most salient instance in all history of the collapse of morale on a large scale is found in the Russian debacle in 1917. A nation of 180,000,000, with an army of nearly 20,000,000 sturdy, fighting men, lost its morale, abandoned the field to the enemy, and in its disintegration tore down the most autocratic regime in Europe and from the extreme of imperialism swung over to the opposite extreme of bolshevism. It will be one of the most complex and fascinating problems of the psychology of the future to analyze and explain this unprecedented metamorphosis, but there is no better single phrase that can now describe it than to say that the Russian morale certainly went into bankruptcy.

On the other hand, history presents no such salient example of both the power and the persistence of morale as in the way in which the Allies endured the shock of the onset of war and the series of overwhelming calamities and defeats of its first three and one half years. England lost her general-in-chief in whom her hopes centered, had to raise an army of a size and with a speed utterly unprecedented in her history, and had a narrow escape from crushing defeat at the Marne. Neither the army nor the people of Belgium lost heart, although overwhelmed and plundered and outraged by the enemy to a degree unknown hitherto. Italy, with her high hopes and early victories, saw her armies rolled up almost to the gates of Venice. The campaign against Constantinople had to be ingloriously abandoned. The French for years saw the enemy raping towns and moving steadily toward Paris, threatening to divide them from their English ally by driving the latter into the sea. Then there were the great surprises of technique sprung by the Germans—Zeppelins, submarines, poison gas, *Flammenwerfer*, and systematic atrocities aimed chiefly against morale, which through all these disasters never faltered, and, after long years of trial, came back with a glorious and complete victory.

Of all the nations probably France, when everything is cleared up, will be seen to have shown the most superb morale, because *la patrie* seems, especially since the end of the Concordat, to have taken the place he'd by the Church in its palmiest days, and the extraordinary religious revival¹ that had swept over the country just before the outbreak of the war was, when it is psychologically understood, perhaps the most important of all the factors that made up the French morale.

I. *Difficulties of Maintaining Morale in This Country.*—In this country we had peculiar difficulties in maintaining ideal morale, both as we entered the war and in the training camps and later at the front. Here, as elsewhere, every day's censored report assured us that the morale of the troops of all the Allies was excellent, and this very iteration betrayed a deep, though half unconscious fear that it might break and thus bring the most dire disasters. That it must and shall not break ("They shall not pass") was our deepest resolve, and hence we sometimes became intolerant in insisting that nothing be said or done anywhere that could lower morale, either at home or at the front. This was the motive of censorship, and of certain restrictions upon our former freedom of speech.

Individual Difficulties of Maintaining Morale in This Country.—Stimulus implies reaction, but in the new conditions of trench warfare men often had to remain passive and not yield even to the impulse to escape. This generated no end of tension, and made men very susceptible to shell shock, which very rarely comes to men in action. (MacCurdy, Babinski, Eder, Crile, Smith, etc.) The bombardments preliminary to an attack were directed chiefly against the enemy's morale. Every kind of activity, mental or physical, within the trenches while under fire safeguards morale. Quiescence under stimuli is very dangerous, and any activation helps.

Gassing, too, is very hard on morale. The possibility of being smothered like a rat in a hole, and the fighting with gas-masks, lessening respiration and interrupting communication, are intense strains on fortitude and bring a new danger of demoralization. Many people have an instinctive dread of all closed spaces (claustrophobia), possibly inherited from cave-dwellers, and men of a respira-

¹ For a brief but brilliant review of this revival see Albert Schinz: "The Renewal of French Thought on the Eve of the War," *Am. Jour. Psy.*, June, 1916, Vol. XXVIII, pp. 297-314.

tory type, whose morale is unusually dependent upon atmospheric conditions, are in special danger.

Special American Difficulties.—We were not, like the Belgians, French, and Italians, fighting on our own soil or defending it from the prospect of invasion, and thus we lacked the motive of desperation. Our wives and daughters were not outraged, our goods pillaged, our industries destroyed, our capital raided by airplanes or fired at by "Big Berthas," our soldiers could have no home leave to "Blighty," and so our stake seemed even less than that of England. Thus, to the average American soldier, his interest in the war was less personal and our country's interest was less material, all of which bears on morale.

We are less homogeneous racially, less unified by our history and national traditions than are the leading nations of Europe. Many of our soldiers were born abroad, as were the ancestors of all of us a few generations back. Scores of thousands of our soldiers knew little English, and about every race and nation of the world was represented in our recruits. It takes generations to weld heterogeneous people into unity. We have not even a convenient or unique name; the United States cannot be indicated by an adjective. (Some have suggested that we might take the occasion of the war, as Russia did to rename Petrograd, and henceforth call ourselves "Columbia," but I think "New Europe" would be a better and more timely designation, just as New England was named from its mother country for nearly all our inhabitants are practically New Europeans.) So, too, there are sectional differences, and we also suffer from hyperindividuation, which is more uncurbed here, even for corporations, by the interests of the public welfare. Hence enemy propaganda, with our large German population, had an unparalleled field for all its activities, and all this is inimical to morale.

We lacked all military traditions and spirit. We had committed two mortal crimes against the God of Things As They Are, which, as history shows, he never allows to go unavenged. First, we were very rich, and, secondly, we were very defenseless. The spirit of Democracy and of Militarism are in a sense diametrical opposites. Although 375,000 men enlisted, we had to deal chiefly with drafted men, taken from the free pursuit of life, liberty, and happiness to totally new conditions, where subordination and discipline are the prime necessities and individual freedom and initiative are reduced to a minimum, with regimentation and prescription unlimited.

We had to cultivate militarism most intensively in order to repress it in the world. We learned that liberty had to be defended by the same means as autocracy must be. We came to respect the military system as not only perhaps the oldest of all human institutions (L. C. Andrews) but as the most important agency in welding individuals into true communities. Sheridan called discipline seventy-five per cent. of efficiency. It is team-work which enables a squad to overcome a mob, which makes men out of flabs, so that war or its moral equivalent has come as a new dispensation to us. To make a soldier out of the average free American citizen is thus not unlike domesticating a very wild species of animal. In subordinating individuals we should not, however forget that the kicker is often the born fighter and needs only the right direction for his energies. All these obstacles to morale we have more or less overcome.

Germany had its own unique morale. It had broken with its past, with the age of Kant and Goethe, with its culture of fifty or one hundred years before even more completely than bolshevism had broken with the earlier aristocratic and bourgeois revolutionists in Russia, and yet both were usurpers claiming the prestige of a preceding stage. The Germans profoundly believed themselves to be the world apostles of *Kultur*, the true supermen called by their fate or genius to subject their neighbors and bring them to a higher stage of civilization. This conviction of superiority, which had grown so strong, coupled with an instinct for discipline and feudal subordination of rank to rank in a long series, was the essence of their morale which, it is our fond hope, has been overcome with the defeat of their armies.

II. *Health and Morale*.—Health is one of the prime bases of morale. Health means wholeness or holiness. The modern hygienist asks: What shall it profit a man if he gain the whole world and lose his own health, or what shall a man give in exchange for his health? In recent years we have seen a great new attention to personal, school, public, municipal, and domestic hygiene, and since the regimen of the Japanese armies in that country's war with Russia showed its importance and since the lack of it in our Cuban campaign was so disastrous, on all sides more stress has been laid on sanitary conditions than in any other war.

The most universal greeting the world over consists in inquiries about our health and perhaps even that of those nearest to us, as if all must recognize its cardinal importance. Now, real health is

not merely keeping out of the doctor's hands, but its cult aims at keeping each at the very tip-top of his condition so that he feels full of the joy of life (euphoria) and capable of doing or suffering anything. Most of the world's work is done on a rather low hygienic level, but its great achievements, the culminating work of the leaders of our race, have been the product of exuberant, euphorious, and eureka moments, for a man's best things come to him when he is in his best state.

War, of course, needs intense physical energy, and the labor of drill and camp-work, which has toned up so many men of poor physique, has left a bequest to morale that ought to long outlive the war. To be weak is to be miserable and to be strong and well predisposes to true virtue. The muscles are nearly half the body-weight. They are the organs of the will, which has done everything man has accomplished, and if they are kept at concert pitch the chasm between knowing and doing, which is often so fatal, is in a measure closed. There is no better way of strengthening all that class of activities which we ascribe to the will than by cultivating muscle.

Food conditions morale. It has always been known that starving troops could not fight. The French scientists tell us that there is a particular type of man, in whom the digestive functions predominate, that is paralyzed more quickly than any other type by any deficiency in quality or quantity of food, and that these may more easily become heroic when defending their stores. Camp Greenleaf applied this principle by giving the rookies who came there fresh from their homes somewhat better food for two weeks than others got in order to make them more contented. In a sense man, like an animal, feels most at home when and where he feeds best, and if man really "fights on his stomach," then fighting on an empty stomach is proverbially hard. Recent studies in this field by the Pawlow school have shown us how fundamental proper metabolism, normal appetite and food-taking are for mental states and processes, and have shown us also how appetite is the mainspring that impels all the processes of digestion down to the very Metchnikoff end of the thirty-foot alimentary tube. Some still think that military life demands stimulants, although others hold that it is easier to dispense with them than in civil life. It does seem to be established by this war that smoking is a wholesome sedative to war strains, and certainly none but a fanatic hygienist would banish the "fag." Despite the needs in this department a soldier's life

requires that he be able in emergency to endure more or less privation even here. Perhaps we may conclude that while proper and regular food is a very important constituent of morale, this can be maintained at a very high level and for a long time even under great deprivation.

Rest and sleep, of course, make a great difference. A tired army is far more liable to panic, and fear often takes cover behind exhaustion. Sleep builds up exhausted cells, rejuvenates, and its very dreams are often a safety valve or catharsis for war strains generally and even for experiences and memories. Thus, too, the time of day has significance. Five-o'clock-in-the-morning courage is a very different thing from that of nine or ten o'clock at night, and darkness and inclement weather are handicaps. Sleep seems to have something to do with finishing the last and higher processes of digestion. While its importance is well appreciated, something of its psychology ought to be taught in every officers' training school.

III. *The Conquest of Fear.*—From the first rumor of war and the draft on to the training-camp, to the trenches, and the charge the chief feeling to be overcome in all men, perhaps in proportion to their intelligence and power of imagination, is fear. Cowardice is fear yielded to; bravery and courage are fear controlled. Fear is anticipatory pain, and mortal fear is of course the anticipation of death. Everyone has heard of heroes who condemned their limbs for trembling, their heart for throbbing, but the brave man is he who learns to control all these physiological symptoms and to do what he ought to do in every emergency. Every symptom of fear is met with near the front and when battle impends. There is weakness, sometimes rising almost to paralysis; unsteadiness of movement; loss of appetite; perhaps nausea, indigestion; diarrhea is very common; flushing and pallor; and an instinct to cringe and dodge and show symptoms of shock at everything unexpected, often at the very slightest surprise. In action many good men lose control of their muscles and become almost automata. Very few soldiers indeed can aim as well as on the rifle range, most shoot wildly, and some seem to lose control of the power of loading, while we are told by a number of high authorities that many fall by the way from sheer terror and that there are far more panics, local and even general, than find their way into history or even into official reports. Thus the efficiency of a fighting force depends more largely than hitherto realized upon the effectiveness of the methods

of repressing or controlling the fear instinct. In the German experience solid formations, advancing elbow to elbow, give a sense of security that makes men face danger more easily than they could in wide-open formations.

A large part of discipline is directed more and more toward making this control effective. Just in proportion as obedience to orders becomes instinctive, so that their execution requires no thought, and just in proportion as shooting, bayonet drill, throwing grenades, and other activities of the combat are made second nature, the chance of their being done aright at the critical moments increases and the hazard of acting wildly is diminished. Facility in these processes that can thus be mechanized also gives a certain degree of confidence, and the soldier feels that if he does lose his head his muscles will take up the task of themselves and that thus his defensive and even his aggressive power will not be lost in the direst emergency. This is one reason why drill must be incessant and long-continued, even though in trench warfare less direct use is made of it. Another reason is because where many men are doing the same things together there arises a sense of solidarity, so that each depends not only on himself but on others, and the individual feels that he is supported by the formidableness of the group.

Where fear is yielded to with abandon almost anything may be done. Men lose their orientation in space and may rush directly at the enemy instead of fleeing from him. In panicky fugues men often tend to flee over the same course in which they have advanced, sometimes going around sharp angles instead of taking quicker cross-cuts to safety because they have advanced along these angles. They throw away their weapons, accoutrements, sometimes their clothes, and run for incredible distances, perhaps leaping into chasms, and are not infrequently subject to illusions and hallucinations. Fear is extremely infectious. Often the sight of a single frenzied fugitive disconcerts and may disorganize a squad of courageous men, so that it is very important to eliminate those especially liable to start panics. We are told that the sight of a single individual fleeing, with all the facial, vocal, and other expressions of terror is more disquieting even to experienced troops than the death of those nearest them in the ranks or a very destructive fire of the enemy. We have a number of records of panic among horses in war, which sometimes attends and even causes grave disasters.

At home, too, fear is an important ingredient in every form of

slackerdom. It has made many conscientious objectors who never objected before but have extemporized a set of pacifist principles to cover their timidity. It is a large ingredient in the symptoms of disease in somatic cases, and often has a real effect in retarding cure, not only of psychic but physical traumata, even in the most candid and honest men, so deep in the unconscious does it burrow. The same explosion may cause shell shock in the guards who are conducting prisoners back of the line and have no such effect upon the prisoners themselves, because they are free from responsibility and realize that they are out of the fighting; while the best statistics tell us that shell shock is from three to four times as common among officers who must not only be brave but set examples to their men, as it is among privates. Many genuine cases of shell shock were cured with surprising suddenness by the news of the cessation of war.

This shows that we are all perhaps far more fearsome than we know, that the instinct of self-preservation is so strong that it percolates down through the unconscious regions of the soul and produces there results which are utterly inconsistent with courage, even in the bravest.

Almost every important event in the soldier's previous life has a bearing upon liability to or immunization from fear. On the one hand, if a man has been used to taking large risks and hazards of any kind in civil life he has a predisposition to take this larger risk. Of course if he has had hair-breadth escapes from danger he may, according to his diathesis, either come to feel that he can safely play with fortune, that he has a good star and the fates favor him, or else he may acquire a special type of timidity of other risks than those he has incurred. Again, even hereditary tendencies may make themselves felt. If for any cause one has acquired a dread of closed spaces (claustrophobia), he finds the trench itself very trying and this dread is greatly augmented under bombardment or in liability to attack. It has been found, too, that those who had childish dreads of thunder storms find it harder to control their terror at the detonations of big guns and high explosives. Others have either innate or acquired horror of blood which perhaps, like all other predisposing causes, may be overcome, if not too intense, or may incapacitate. Those with dread of open spaces find it far harder to charge in very wide open order and prefer hills, trees, or even water to a dead plain across the hell-strip between the front lines (MacCurdy).

In general every soldier realizes that he is increasing his chance of death in going to war, and this sense is the key to some of the most interesting results which scientific psychology owes to the war. It is hard work and requires long practice to be truly brave. The most imperative of all instincts is the love of life, and to deliberately risk it involves severe nervous and mental strain. But the consensus of mankind which despises cowardice is right, because there is probably no such test of human metal as whether or not and how soon and effectively the strongest of all instincts can be controlled.

One of the greatest problems, if not the chief one that overtops all others for officers is how best, soonest, and most effectively to teach the control of fear. This is also a most important problem for each individual soldier, and how he acquits himself in this task is perhaps the best measure of military efficiency. How can this be done?

It is quite impossible at present to enumerate all the means, direct and indirect, which contribute to this end, for there is almost nothing in a soldier's activities or in his environment that does not in some way bear upon it, and every day's experience helps or hinders this power of control. We can only enumerate here some of the most general and effective aids.

1. When the soldier is lying in the trenches under heavy bombardment, or when he is on distant outpost work in the dark, or wherever instinctive activity, of which danger is the greatest stimulus, is hindered, the morale of courage can never long survive if the mind is focused solely upon the peril; and here, then, we see how the mind inevitably turns to the chief mechanism possible in such conditions, namely, diversion. Any kind of activity or occupation that takes the thoughts away from the immediate danger, however routine the work may be and whether ordered or self-enforced—moving about, conversation, cigarettes, especially a joke, information passed along the line, which sometimes is designed only for this end, even some added discomfort like inrush of water or the necessity of digging out a closed communication, anything to eat or drink—all this helps to relieve, if only momentarily, the strain which may otherwise be so great that the order to go over the top, even in a grilling fire, comes as a relief. Never has the need of diversion been more recognized or more supplied, all the way from home to the front, than for the American soldiers in this war, and its power for morale can never be overestimated. Of all these diversions the best are those that involve the most activity, whether

of mind or body, on the part of the soldier himself. It is far more effective for him to act in a play or sing in a concert than to be merely a spectator or listener.

2. The second corrective of fear is example. Of this we have had endless illustrations. Even the narration of a brave deed, or a decoration for heroism conferred upon one whom a soldier knows is a powerful incentive to emulation, so gregarious is man. An instance of it actually seen is, of course, far more impressive. Hocking tells of a piper who found a large company of men who had thrown themselves on the ground, exhausted and in despair, expecting annihilation, who were rallied by two friends, one of whom marched up and down with a penny whistle while the other imitated playing a drum, until the wearied men were given cheer and arose, saying, "We'll follow you to hell," and were finally led to safety. Here the example of the officer is, of course, the most potent of all. Often every eye is upon him to see if he flinches, hesitates, or wavers. If he is cool most men will follow him anywhere, so contagious is courage. In every group of soldiers that become well acquainted there are individuals, sometimes officers and sometimes privates, to whom in danger their comrades turn instinctively for their clue.

3. Some temperaments are able to establish their morale against fear by working themselves up beforehand to a full realization of their peril and of the chance of a wound or even death, and accepting the situation once and for all. We have the best instance of this that I know of in the records of a number of French youth. They thoroughly realized that they had entered upon a course which might have a fatal termination, and devoted themselves at the outset, as martyrs if need be, to the cause which was far greater than their own life. Having made this great decision, they found it gave them strength and poise in critical moments. Not very many, however, save intellectuals and by no means all of them are capable of this type of conscious self-immolation.

4. Far more acquire a kind of fatalism. Some optimists come to believe that the bullet they are to stop has not been cast, while more find relief in the sense that the lot has already been cast in the lap of Fate and that they are to live or die more or less irrespectively of anything that they can do. This is akin to the Stoic fatalism, the Mohammedan kismet, or the Puritan will of God.

5. Some, probably by no means as many as churchmen expected, find genuine nervous poise in a religious belief in life after

death. This is probably nowhere near so effective in modern armies as it was among the old Teutons, who believed in Walhalla; or among the Moslems, who held that the dead warrior passes to the lap of the houris in Paradise; or in Cromwell's Puritan "Iron-sides." The sentiment lingers on, but more in the realm of poetic fancy and dim, vague feeling than in conscious conviction. The sense that death will bring honor to friends, or be a sacrifice which the country or the cause needs, involves a higher type of idealism than most soldiers can make into a very potent assuager of fear. Despite all that is said of the glories of dying for one's country or for liberty the analyses that have been made of patriotism show it to be a complex of many elements but not yet of prime significance to this end.

6. Probably the chief and most practical factor in the conquest of fear is familiarity. Long before he actually smells powder the soldier's fancy irresistibly dwells much upon his possible wounds or death, while as soon as he nears the front he sees the victims of battle all about him and even sees his friends and comrades fall. He serves his turn on the burial squad and has to bring back the dead and wounded to the rear. This gives a certain immunizing callousness to it all, and he becomes very familiar with the thought that he may be the next victim and so accepts the fact with growing equanimity. The seasoned fighter learns to fight on even though his mates are falling on all sides in death or agony. Human nature can get used to anything, and wont raises the threshold of temibility higher than anything else.

IV. *Morale and Death*.—In peace death and everything connected with it has always been the most solemn of all themes. The sick- and the death-bed, the last tender services, the final breath, the closing of the eyes, pallor, coldness, the preparation of the body, the shroud, coffin, funeral, entombment, and mourning, with all its depression and its trappings,—all these things make the supreme appeal to the human heart and mind. The transition from warm and active life to a putrefying corpse has always shocked the human soul as nothing else has had the power to do. Every known savage tribe sooner or later puts its dead away because the mind and the senses of man cannot endure the phenomena of decomposition. Hence interment, cremation, burial in water, desiccation in air, towers of silence, are all to disguise or divert the soul from this supreme horror. Sepulchers, monuments, cairns, pyramids, epitaphs, are also disguises (*Decphenomene*),

just as one motive of dress from the primitive fig-leaf, and also personal adornments and toilet and marriage ceremonials have as one of their motives the diversion of attention from the organs and functions of sex to other parts of the body or to secondary sex qualities. Many tell us that the prime motive for a belief that there is such a thing as a soul, that it survives the body, that its fate may be more or less followed through the vicissitudes of a future life, was to distract attention from rotting carrion to a more beautiful set of images and to relieve the shock of the primitive fear that death had ended all. All funeral rites serve two contrasted ends. On the one hand, they either help us to realize that our friends, whose death perhaps we have not personally seen, are really dead, which is so hard for us to conceive, that they will return to us at least in the form of dreams unless the ghosts are thus laid; or else they are to turn away our thoughts from the physical phenomena of the decay of the flesh to memories and hopes, and to mitigate the shock by a compensatory belief that some part of the dead yet lives.

War brings not only the community but especially the soldier to a radically different view of death. He is not only liable to see his comrades mutilated in every conceivable way and pass in a moment from the most intense life to the most agonizing death, but he must often himself gather the mangled fragments of the bodies of his comrades, and very often, in excavations or by the disentanglements caused by shells, envisage every stage of decomposition of those previously interred in ways that Barbusse has so gruesomely described but which even pictorial artists forbear to portray. Thus to the soldier every kind of camouflage of death is rudely torn away, and he meets it in all its ghastliness at first hand. Not only this, but while in peace murder is the worst of all crimes it now becomes the chief of all duties, for it is the goal of all his training and preparation. He must inflict it with all its horrible sequels upon as many of the foe as possible. Worst of all, in some sense, is the fact that whereas in civil life death usually comes to the old, the weak, or the sick, and occurs only at rare intervals to those we know and love, now it suddenly sweeps off masses of the strongest and best in the very prime of life. This brings death home to the soldier and the community in a far closer way. The soldier must harden himself to all this at short notice as best he can and to such a degree that his efficiency be not abated, his courage fail, or his spirits droop. This is the acme of all the strains put upon his morale.

The responses, both conscious and unconscious, to this situation are manifold, and psychology is not yet able to evaluate or even tabulate them all.

(a) Some, as we have seen, react by bravado. They affect to laugh death in the face, and make ghastly jests about the most agonizing of all these experiences. With some temperaments this initial affectation of callousness is so instinctive and often effective a method of hardening a soul to travel this viaticum of woe that we must not condemn it without some of the insight that sympathy with the dire need of this emergency can bring.

(b) Others develop the impressions and convictions of their early religious teaching and are more or less steadied by a belief, or at least a hope, that if their bodies die there is an immortal part that will not only survive but meet a reward in some "boathouse on the Styx." This inveterate instinct undoubtedly acts unconsciously and buoys up many a heart without any very conscious conviction and without any form of outer expression, for the soldier thinks it cowardly to revert suddenly to a faith which he has neglected through all his post-adolescent years. Only poets and spiritualists or pronounced religionists are able to formulate these anticipations of personal immortality, or even to conceive that the souls of those who die continue to strive above, as in Kaulbach's famous cartoon, or that they go either to Walhalla or to the houris. The latter view is so in line with the deep instinct to find in love compensation for the hardships of war that it makes this creed perhaps the ideal one for the soldier. No doubt the experiences of war tend to at least secretly develop every such proclivity where it exists, and this has been best and most sublimely expressed in the often very confessional memoranda of French soldiers.

(c) Many, however, if not most soldiers today refuse to consciously come to very definite terms with the problem of their own death but only feel, as Winifred Kirkland³ well puts it, that somehow their immolation, if the worst comes, will not be in vain but that their influence will be some kind of a pervasive power for good, even if it works impersonally and *sub specie eternitatis*. Their life is so intense, their effort so strenuous that the merit of it all cannot be entirely lost. They are on the path to glory and it cannot all end in nothingness, even if oblivion close over their personality. Somewhere, somehow in the cosmic order their life and death will not have been in vain.

³ *The New Death*, Boston, 1918.

(d) It is the very fact of the soldier's super-vitality-and-activity, which means the farthest possible remove from death, that makes so many soldiers optimistic fatalists and causes them to feel if not that they have a charmed life that they will somehow escape. The glow and tingle, and perhaps especially the erethism of war often make the healthy soldier feel that he has too strong a hold upon life for death to be able to stop him.

There are more than three hundred distinct graveyards definitely set apart for the dead in the three hundred miles that stretch from Flanders to Switzerland, which is thus itself today the world's greatest cemetery. More and more friends at home feel as Harry Lauder did about his son—that he ought always to rest in this vast field of glory, and many writers have expressed the belief that these "God's acres" should henceforth and forever be too hallowed for any armies to fight over and ought to be more defensive than fortifications. In the early stages of the war many who were buried here, often uncoffined, in trenches near where they fell and perhaps sewed in a brown army blanket with a Union Jack laid over them⁴ will never be identified. Not a few of these earlier cemeteries had their crosses or inverted bottles, containing the names of the soldiers, torn away, while very many bodies were disinterred by the shell fire of later engagements, and many trenches had to be run through them without involving reburials. But later every effort was made by special organizations in each of the allied countries to preserve the identity of every fallen soldier no matter how mausolized his body was. In England a Graves Registration Commission under General Fabian Ware was appointed, which sought to trace everyone from the last time he was seen to his final resting place and to send information and souvenirs to his relatives. Identification was later stamped on an aluminum tape, and the exact site of each grave entered in a register. There are various kinds of wooden and iron markers, with separate lots for Orientals. These registration units have done much to bind France and England. When the English came the French said, "We leave you our trenches and our dead," and have given the English permanent cemeteries. The desire by the friends for assurance that their dead have found a grave, that it is being tended, and that they "lie comfortable," all this is now very effectively taken care of by voluntary

⁴ *The Care of the Dead*, London, 1916. See also LORD NORTHCLIFFE: *At the War* in the chapter "Search for the Missing," p. 133; and ALFRED NEY: *Le Droit des Morts* (1918), with 70 photographs of graves.

means, and here the Red Cross has done some of its best work, verifying records and affixes with dates, collecting everything found on the body and sending it to relatives, and answering every inquiry possible.

Major Pierce was given complete charge of our Graves Registration Bureau, which marks and erects crosses, uses a symbolic medallion, and photographs graves collectively and individually for the next of kin. It is more and more felt to be a blessed service to rescue from obscurity those who have fallen. Larger monuments are to be erected by the different countries, and an international federation has been established to develop military sculptures for them. Land was permanently given by the French to the American Expeditionary Force, and several of the larger plots have been fenced and posted while smaller ones were arranged near the front with a unit of two officers and fifty men provided for each divisional cemetery, the size of these units to be increased when necessary.

Provision is made in all countries to separate if possible the dead of the enemy from those of the home army. In Germany great attention is given to this subject, and competitions have also been instituted for the best tombs for individuals and for public group monuments.⁵ Some of these plans are most striking and seem to us in shocking taste. Some are high mounds like those of the Vikings for burying men in mass on the battle-field. Some are solemn mausoleums, others circular enclosures; some suggest cairns, pyramids, towers; one is a solid block-house; many have swords, spears, and helmets, while the iron cross is very common. From one a dozen tall parallel spears emerge. Metal insignia often half cover the stone work. One vast tree-shaped monument is covered with individual plaques. The characters are often runic. One shows two rows of hands, twelve in all, bearing an upright sword.

As to mourning, President Wilson approved the recommendations of the Woman's Committee of The Council of National Defense that three-inch black bands be worn whereon a gilt star might be placed for each member of the family who lost his life in the service. England was the first to advocate simpler mourning and the restriction of crêpe. Even in the Boer War Queen Victoria suggested that the morale of the people might be improved by less black. France followed to some extent this movement in England,

⁵ *Soldatengräber und Kriegsdenkmale*. Wien, 1915.

and leaders of fashion there have done much to simplify mourning and to make the hat, the veil, shoes, and dress less ultra-fashionable. This movement, while it has impressed itself somewhat upon ultra-fashionables has had a far more beneficent effect on the women of the middle and lower classes who desire to show in their habiliments the sorrow they so profoundly feel but lack means or are engaged in occupations which make ceremonial mourning difficult.

Cora Harris has written a mystical story of Lee and Grant and other great fighters of our Civil War going to France in spiritual shape, hovering above the regiments and guiding the brain and nerving the heart of the novice. She might have gone farther and imagined Washington, Jackson, Paul Jones, Lafayette, and also very many of the heroes of defeat (see W. J. Armstrong's *The Heroes of Defeat*, Cincinnati, 1905) thus aiding our troops. It is well to remember here that many believe that the gods themselves were originally worshipped as ancestors, and that in the code of the Japanese bushido the dead were a tremendous power in her war with Russia. We should do far more than we do now "lest we forget." The best memorial to the dead is to carry on their work, and there are many who believe that this country in its past has gone farther than any other toward ignoring what it owes to those who have given their lives that we may be free and prosperous. Most that we are able to do we owe to ancient benefactors, the memory of far too many of whom has perished from among men. While, therefore, we may be less certain of personal survival and reward in another world for those who die in a great cause, we can do very much to give them a compensatory mundane immortality that must make a powerful appeal to every soul capable of loyalty and devotion to a cause greater than himself. From all this we see that the morale of those who go out never to return, and whose last words, whatever they were, we shall tend to cherish as a kind of *morituri salutamus*, as well as that of their survivors in the field and at home, has no more fitting index than the way in which those who have met the great defeat are enshrined in our memory.

The only meaning of the new death is how it affects life. To the philosopher who sees and knows that there is nothing beyond the grave fictions about the soul's future have a very high and a very diverse but a solely pragmatic value. We know nothing whatever about it and probably never can. Death is simply the great *tabula rasa* on which the imagination of every race, creed, and even individual paints, and to the very few who can think unselfishly about

it the holocaust of the war only intensifies the consciousness of our sense of nescience. It is the great void in which the intellect discerns nothing but total blackness but which feeling, wishes, fear, and fancy always people with their creations; and these creations do profoundly affect our lives and also the way in which we meet the thought or the reality of our own death. It is these war stimulates and makes very real.⁶

The soldier's attitude toward death is often very fluctuating; it varies inversely with the love of life. Sometimes when in great depression he exposes himself, hoping that a bullet will bring surcease from all his troubles and feeling that death would be a most welcome relief. The scholarly soldier asks what is the use of all his study if he is to be cut off. If there is a future life it must be a rather drab platonic communion with ideas which is more suggestive of death than life as Plato defined philosophy as the love and cult of death. Again, the young man feels that he has done too little to justify his survival and perhaps finds comfort in the face of death in the conviction that he never will. Again, he revolts at the prospect of his happy youth so tragically and suddenly closed. On the other hand, if he has been good he rejoices that he may be cut off before age with its temptations can spoil him, feeling perhaps that he is better now than he will ever be again. He has accomplished little in the world and perhaps his whole existence is to be futile and

⁶ The best collection of data illustrating this is found in MAURICE BARRÉS's *The Faith of France* (Chapter X) where he prints the very systematically collected letters of many young French soldiers who wrote down their own thoughts and feelings about death and later suffered it, to each of which he adds his own comments. See also *Lettres d'un Soldat* (Paris, 1916, 164 p.) by an anonymous painter, a solitary and obscure genius who, like Oliver in Rollands *Jean Christophe*, every day made in mind the supreme sacrifice. Even in the trench and under fire he brooded on the beauty of the starry night, dawn, etc. The macabre of battle could not keep his spirits down. His intellect found little stimulus in war but his spontaneous emotions filled his soul to overflowing. Thus the soul heals its own wounds, like a skillful surgeon, often even while the critical faculties looking coldly on know that these are only consolations. See also P. BOURGET's *Le Sens de la Mort* wherein the skeptical surgeon, Dr. Ortigue, dying of cancer and knowing death to be extinction, operates in his hospital at the front till the end. His words and example bring his far younger wife to share his belief and to vow to commit suicide with him in the end. She is saved, however, from this after he dies by the example of a wounded young soldier who dies like a true Christian extending the crucifix over her. The faith of this hero overcame the skepticism of the scientist and the young wife promises to live. A still more sublimated and ecstatic faith is found in BORSI's *A Soldier's Confidences with God: A Spiritual Colloquy* (1918). Other books on this subject are L. DE GRANDMAISON's *Impressions de Guerre de Prêtres Soldats* (1916), and L. BLOY's *Méditations d'un Solitaire* (1916).

vacant. Then he alternates to a kind of animal hatred of death. Later he avows atheism and thinks that those who share that belief and the mystics are more truly religious than the Christians. Thus the soldier in his secret soul is prone under the stimulus of impending death to develop the germinal attitudes of about every philosophy and creed one after another, flitting from positive to negative views according to his mood or the changing circumstances of war. Scattered through the confessional books of soldiers we can already find abundant examples of this and it would be easy, if there were space, to collect an anthology to illustrate it, although it more often takes place, especially in more uneducated and inarticulate souls, rather below than above the threshold of consciousness. But it is certain that the war has stimulated active souls to repeat in the often unplummeted depths of their feeling about all the efforts that man has made to come to terms with the King of Terrors.⁷

V. *The Morale of Humor*.—This is far more seen in the Anglo-Saxon race and in those who speak the Romance languages than among the Teutons, whose rancor in war makes them so serious that none could accuse them of the "curse of jocularity." Humor is perhaps the very best camouflage for fear. In looking over files of the trench journals of the Allies nothing has struck me more forcibly than the desperate and pathetic attempts to jest, even about death itself in its most horrid aspects. This often seems most shocking to civilian readers, while some of the attempts to joke are so abortive as to be simply pathetic. Coningsby Dawson writes, "Pretty well every man I have met out here has the amazing guts to wear his crown of thorns as though it were a cap and bells." Jests normally belong to the most carefree moments of life, but at the front they are used to cover up the most serious and solemn of all human experiences, viz., the envisagement of death. The instinct to turn the most solemn facts in the environment into a theme of laughter is partly an attempt of the individual to release his own thoughts from a present too excruciatingly agonizing to be long borne, but it is also partly to signal to others that he can keep his soul free and happy in the face of danger; while a third ingredient is the social one of heartening others to do the same. Thus a "funny" man in the army is a godsend, and men instinctively turn

⁷ ARTHUR GRAEME WEST: *The Diary of a Dead Officer*. This soldier in his letters and poems illustrates more of these moods than any other I have found, but it is most common in French memoirs.

to the mirth-maker, even though they are conscious that his levity is half affectation. In peace and in sickness it is often a great resource to be able to see the humorous side of things. It indicates a superfluity, margin, or reserve of energy and rests from the acutest mental strain, even if it requires a certain bravado. As has been often remarked, humor is more obvious and perhaps strained in the early stages of a war and tends to die out as men become seasoned. It is the new recruit who strives most desperately to be merry over cooties, mud, fatigue, and the rest, for it is at bottom a defence mechanism. The rookie would fain be able to look the most horrid form of death straight in the face and laugh and snap his fingers as if defying him to do his worst. It is not impossible that this instinct now in some sense vicariates for the anticipated joys in some warriors' heaven, which was clung to as a kind of compensation for death. At any rate, the soldier who is devoid of humor lacks one of the elements of the morale of good psychic regimen.

We should go mad with the tragedy of the atrocities of this war if there were no diversions from it, and Harold Bigbie is woefully wrong in thinking it is all too serious for fun or that soldiers at home are shocked by all mirth-making and would think a funereal mood the best. This logic would banish fun from the world, for life itself is not only serious but a battle. Someone has called the French shrug and smile a mind-sweeper. It means superfluous vitality. The American soldiers who marched down the middle of a Paris street with a deadly air-raid above, carrying Japanese paper parasols as a protection, invoked laughter from those who had crowded the doorways and bomb-cellars while explosives were falling all about; the boy who showed a sympathetic chaplain what appeared to be a Morocco-bound Testament in which a Hun bullet had been stopped and so saved his life, though it had wounded him severely, and, after listening to the obvious religious lesson, showed him that it was a pack of cards; the noted English airman at St. Quentin who stole high up into the air, disguising the identifying marks of his machine and drawing a fusillade from Teuton aircraft guns, who dropped what seemed to the terrified crowd below to be a bomb, which proved to be only a Rugby football that instead of exploding bounded high into the air; the straw and plug hats an American company wore from a nearby hat-shop in place of their helmets; the fun of the Sammies with the French language; the pet names given to effective big guns; the acceptance of the French perky Nennette and Rintintin against air-raids, worn everywhere by

both sexes; the incessant and clever application of the familiar terms of football and baseball to war incidents; the rich and clever trench slang; the interest in films of the Chaplin and Fairbanks order; the passion for farce, satire, extravagant comedy, and extravaganzas—all these and countless more serve many a purpose of high morale. First of all, laughter makes friendships, even with those who speak another tongue; a mutual smile brings souls together. Again, it flaunts the fact that one refuses to be scared; and, thirdly, it transforms pathos into humor, just as Hood when dying of consumption found comfort in caricaturing his own more and more lethal symptoms. Momus never played such a rôle as in this most tragic of wars, and when all this material is assembled and duly explained he will be shown to have had no insignificant part in winning it.⁸

VI. *The Morale of Hate and Anger.*—Anger is the most sthenic of all states. A man who is thoroughly mad to the point of abandon can do and say many things impossible to him in any other state. It rings up latent powers of nerve and muscle, it flushes the blood with the most combustible of all the high explosive physiological products, adrenalin, like oil sprayed into a furnace. Savages work themselves up to a frenzy of rage before rushing upon their foe. Hate, for our purposes here, may be considered as a kind of deep-settled and prolonged anger, or at least a permanent possibility and proclivity to it. The conditions of modern warfare, however, are radically changed in this, as in so many other respects. The boy who is liable to fits of Berserker rage and warns his pal not to get him "mad" has no place in the modern army. The old morbid *iracundia*, excessive touchiness, and even the old *furor teutonicus*, which was so terrible in primitive Germany, avail little in campaigns where the enemy is so rarely seen and remains impersonal. It is a little doubtful whether the German songs of hate and their cult of hatred, especially against England, have made them really more effective in war. Kipling's threatening poem when England begins to hate, the old appeals to this impulse in the cry, "Remember the Maine" or "Remember the Lusitania" have produced really little result. Such waves of public indignation are generally more or less harmless and transient vents of animosity. Even in a bayonet scrimmage of man against man the evidence indicates that not so much hate as the instinct of self-preservation impels the thrust

⁸ The Psychology of Tickling, Laughing, and the Comic. By G. S. HALL & AR. ALLEN. *Amer. J., of Psychol.*, 9, No. 1 (Oct., 1897).

fatal to the enemy. Moreover, Fritz when captured or met under any other conditions is found to be not such a bad fellow. He is, after all, but a man much like ourselves. Again, it is very difficult, if not impossible, to maintain anger for any length of time at a high pressure. Its very nature is more or less fulminating, and there is a certain tendency to subside and to lapse into a state of indifference, or perhaps even to react to a certain degree of friendliness by the law of compensation.

True, the wrath of Achilles was the theme of Homer, as the wrath of God is one of the chief themes of the Old Testament, and the achievements of Orlando Furioso sometimes have a certain epic sublimity; but the day for all this has passed. Even the outrageous atrocities of the Germans leave only a deep and settled conviction that something drastic must be done to prevent their recurrence, and they can hardly be said to have furnished the motive of chief strength in the conduct of the war. Never was there a more colossal psychological blunder made than when the foe decided on the method of frightfulness, for by this he aroused a deep and righteous sentiment of retribution which had the very opposite effect from that he calculated, namely stimulating recruits and loan subscriptions and nerving the arm of the Allies with something of the energy of desperation. It was these deeds and the ever clearer conviction that they were planned with deliberate purpose that has done more than even the ambitions of conquest and the affront to the rest of Europe implied in the superman assumption to make real peace hard, and put off beyond the vision of those now living the day of the reestablishment of international friendliness in the world. Men can pardon legitimate war but not these unprecedented barbarities.

The whole spirit of the Allies, especially of the English, was totally different. They took into the field the habits of games played according to rule by gentlemen who would scorn to take an unfair advantage, in which even the less noble-minded of the contestants were anxious that only the best man should win. Games are played with the utmost energy and sometimes almost desperation but never with personal antagonism. And so the war on the part of the English was a repulsive job that simply had to be done, like the cleaning out of Augean stables. The more monstrous the atrocities, the greater the need of quelling the menace. Instead of cultivating hate in the school and the community this was left to itself, and the chief appeal was to a sense of need and

duty to down the Kaiser as the common enemy of mankind or like a mad dog.

I heard a college president preach to soldiers that instead of hating the German when he thrust his bayonet into his abdomen he must love him and offer a silent prayer for his soul. Such an attitude is a psychological impossibility. It may be a relic of the savage custom of propitiating the souls of victims lest their ghosts come back to wreak vengeance on the slayer; but even this was done not in the heat of conflict but afterwards.

We conclude, therefore, that it is not only legitimate but necessary that our soldiers should know authentically and impartially all we can tell them in regard to outrages that lie without and beyond the sphere of war precedents and of humanity.

The Frenchman who had seen his home or that of his fellow-man destroyed, his orchards ruined, his tools and cattle stolen, his wife, daughter, and sister outraged or enslaved, must have found in hate and revenge a tremendous source of militant energy. We have many instances which show how he burned to give the Germans a taste of their own medicine, and how hard it was for him to refrain from all excesses when after the armistice he crossed the German frontier. This we Americans can sympathize with but can never feel, for we have not suffered in this way.

Thus with the conquest of the German arms we must believe at least that the policy of frightfulness in war has been given its *coup de grâce*. Never again will a nation, however arrogant and powerful, dare to arouse the awful Nemesis of revenge by thus outraging, as the Germans have done, the basal instincts of humanity and justice. The bitter resentments thus kindled will die slow and hard. At the moment of writing they threaten to impel the French toward a policy of reprisals, which are abundantly justified but which the other nations believe should be repressed from motives of policy. Thus we should see clearly all the hateful things the enemy has done and should not attempt to restrain our righteous indignation. But wars, especially long wars, will be won, if they scourge the world again, as this one has, not by anger; and no nation after this object lesson of its futility will ever adopt the policy of atrocities.

VII. *Morale and Sex*.—This has always been as vital as it is a delicate problem with soldiers in camp and in field, in peace and in war. The Vienna surgeon, Billoth, long ago gave us a graphic account of the introduction of syphilis into Europe by the army

that returned from Mexico in the early history of America, and tells us how the infection spread like a plague before the always slow but sure development of at least partial immunity which time brings. Where soldiers are gathered not only do lewd women congregate, but such is the fascination of the uniform that there is always a great increase of free liaisons with previously pure girls.⁹ The German policy is to assume that there will be irregularities and to instruct every soldier in the use of preventative and prompt curative measures and to rely but little upon moral prophylaxis. In England and this country preventative methods and moral suasion are more relied upon, and the infected soldier is compelled by penalties to report promptly for treatment. With us there is still shame enough so that this acts as a deterrent and we have more faith than the Germans in admonition and warning to keep men straight.

War is, in a sense, the acme of what some now call the manly protest. In peace women have invaded nearly all of the occupations of man, but in war male virtues come to the fore, for women cannot go "over the top." Some have even ascribed one of the fascinations of soldiering to the half-conscious satisfaction men feel that here they have escaped female competition and found a field in which their own activities can have free course without rivalry of the other sex. The two chief elements in human nature are, (1) individuation, which bottoms on hunger and which in the first dozen years of life prevails; and, (2), genesis or the transmission of life to future generations, about which the home and so many other institutions of society center. In war the first of these tendencies is chiefly stressed. The Freudian theory that general anxiety, out of which all the phobias, most neuroses, and about all psychoses evolve, can always ultimately be traced to some flaw in the *vita sexualis* has been refuted by the experiences of shell shock, which is always connected not with sex or race but with the instinct of self-preservation.

Our government very wisely made often rather drastic conditions, first for the location of camps and afterwards for their regimen, with a view to minimizing the dangers from this source. A five- and in some cases a ten-mile zone of purity was drawn about the cantonment, and in every camp some special instruction has been

⁹ See another somewhat unique French relation of the sexes in H. DE VISMES: *Histoire Authentique et Touchante des Marraines et Filleuls de Guerre* (Paris: Perrin, 1918), and for a worse side see G. A. SCHREINER: *The Iron Ration*, Chapter XIX (N. Y.: Harper, 1918).

given. When a man has drilled and worked eight or twelve hours a day he is little prone at night to go any great distance to satisfy his fleshly instinct, and so fatigue has sometimes been specially cultivated as a safeguard.

Now, war involves the most intense of the activities of both body and mind, and we know now that chastity and self-control are essential prerequisites in enabling men to undergo all kinds of war strain. We do not understand precisely how the hormones from the sex organs find their way to the higher centers, but it is certain that they do and that those guilty of self-indulgence have less reserves to draw upon for any emergency. Sex is the most capable of metamorphosis of any human instinct, and the study of sex perversions and erotic fetishes show that it can become associated with almost any object or any act. Erethic symptoms may be connected with almost anything so that it may cause excitement. Even fervent prayer and other religious experiences may excite it, and it has no end of surrogates in the imagination, of which it is the greatest of all stimulators. The soldier, like the pugilist training for a championship bout, from the standpoint of the higher hygiene really ought to and does entirely forego for the time being his exercise of the procreative function. It should by every means be held in abeyance. The reciprocal relation between it and intense activity of body and mind is shown in the fact that those who suffer most from war strain are very often impaired in their quality of parenthood. This conclusion of eugenics now rests upon data that can hardly be disputed, although we are certain in the near future to know much more about it in detail. Nicolai even states that he cannot find one of the great men of the world who have been sired by a soldier who had been through severe campaigns.

Again, all, and especially young people, need excitement. They crave it and seek it, and in forbidden ways if normal and legitimate ones are not open to them. The young man longs to tingle and glow, to let himself go until he feels something within take him up and carry him along with a strength not his own. In some cases an explosion of anger has cleared the air like a thunder storm and brought "the peace that passeth understanding" afterwards. An ebullition of fear or any other strong emotion brings a kind of reënforcement. The psychology of alcohol shows that most people drink for the heightened vitality of mind or body that it brings, rather than for the mere physical pleasure of imbibing

liquor. If, therefore, we wish to establish the conditions where sex excitement is liable to break out and pass beyond all control, we have only to make life dull, uninteresting, monotonous, and especially to take out of it all strenuous endeavor. Thus again we can see how war of all the occupations of man, because it is the most exciting and the most strenuous, makes not only possible but imperative for its supreme success the highest degree of chastity.

In point of fact, however, war in the past seems to have tended to the opposite result. The very increase of vigor that drill and camp activity and regimen impose predisposes to temptation. Moreover, there is a deep, old racial instinct that finds partial expression in the phrase, "None but the brave deserve the fair." Primitive man and even animals often engaged in their most violent conflicts for females, who were the reward of victory, and this has been a potent factor in making the best survive. It is thus that the strongest have left progeny. There is nothing that the female, human or animal, more admires or finds more seductive than the prowess that wins a conflict, for that means the power of defense and protection. Thus it is that soldiers home on leave have to meet special temptations.

Moreover, the very hardships and brutalities of war, the harshness of discipline, and the exhaustion of training and encounters tend to ebb ambivalently so that the soldier feels that he has, in a sense, earned the right to self-indulgence and instinctively turns to the more tender and now more alluring companionship of the other sex.

Again, war always tends to loosen family bonds. It brings perhaps a long separation of husband and wife and hence former moral restraints tend to relax, and we now have new theories galore that look toward greater license. Lapses tend more or less to be condoned. The tempter has a larger field at home, and the man in the field, perhaps realizing this, allows himself unwarranted liberties. Eugenic theories are sometimes invoked, and perhaps never was the whole subject of the relation of the sexes more open in the secret thoughts and hearts of men and women in ways that have found expression in speech and print so shocking to more conservative minds. The very tension of absence and abstinence makes the mind more open, not merely to dreameries but to theories that vicariate for the new restraints and the new temptations.

In view of these conditions what does morale in this field demand? I reply:

(a) Perhaps first of all that the very closest relation be maintained with home and with friends. Mother, sister, sweetheart, wife, now have the opportunity and incentive to make their influence most effective in keeping the absent son, brother, lover, and husband loyal and pure. They should realize this responsibility and exert it to the uttermost, and "keep the home fires burning" in the heart of the soldier by every means in their power,—by frequent and wise letters, gifts and reminders,—and make him feel that the family ties, however far they have been stretched, are not broken.

(b) Camp activities not immediately connected with war have perhaps the second place. Real and especially active interest in camp music, in the camp library, in dramatics and every kind of entertainment, incentives to learn the French language and geography, to peruse war literature, and, perhaps best of all, to carry on any line of study to which the educated soldier may have been devoted—all these have their place here. Best of all are athletic games and contests. Everyone who has a specialty of any kind that can interest others or stimulate competition has also a salutary, alternative function.

(c) In place of direct instruction ("highbrow smut-talks"), which have little effect, there have been a few brief leaflets that must have been very effective. The medical examiner and subordinate officers can, if informed or awake to their opportunities, often drop side remarks in the most incidental way, which the soldier seizes with avidity because he does not consider that it is aimed at him. We should remember that in the field of sex the briefest hint, which could ideally be dropped as if its author was entirely unconscious of its significance, will be understood and assimilated most uniquely. Sex teaching is not like teaching a school subject, as so many of the swarm of men and women who have lately written upon it assume. The principle should be *verbum sapientis sat*, and nothing is more offensive to a healthy soul than to read or hear the platitudes spun to such tedious length as in several scores of books of this character which I have collected during the last quarter of a century. The physician is far more effective here than the clergyman or the Y. M. C. A. man. A physical trainer in one of our largest colleges, who has had a score of years' experience, tells me that in single remarks which he makes it a point to casually throw out at the moment he has a student stripped for measurements he believes he has done more good than in all the stated lectures it has been his duty to give.

(d) Scare-talks on the dangers of infection no doubt did once, and still in some cases do have great effect, but there is little new here now even to the average private, and familiarity with this sort of thing has immunized the souls of most so that it has little effect. The ideal, too, of keeping oneself pure for the sake of wife or posterity still has its effect, although this has perhaps of late been rather overworked. Its appeal ought of course to be very strong. Dissuasion on religious grounds probably counts with more soldiers, and here we must admit that the priest has shown himself in general far more effective than the Protestant clergyman. I believe that the most effective appeal of all, however, can be made on the basis of body and mental perfection. Every young man has athletic sympathies, and if he can be shown that purity is the best way of keeping the body at the very top of its condition and of laying in a larger store of reserves against every emergency, an essential step can be taken to make him a practical idealist in this field. But we must not forget that the chief reliance will always have to be placed upon diversions and physical regimen, because we are dealing here with an urge that has its origins and deploys largely far below the threshold of consciousness. At no point does morale coincide more closely with morality. As transcendental sanctions are losing their power, we must build up on a natural basis a new prophylaxis and be able to show that anything is right or wrong according as it is physiologically *and socially* right or wrong, and precisely this the new sex psychology is now engaged in doing.

(e) Only the few intelligent officers or graduates will find help, and they will find great aid for themselves and for a few of their more intelligent friends whom they can influence, in the new and larger interpretation of sex that psychoanalysis has revealed. Normality of the function that transmits life involves more and more emphasis upon secondary sex qualities, more spiritualization of sex, a realization that moral, social, religious, and intellectual life, and not only that but sanity, emotional, volitional, and intellectual, depend upon the proper regulation of this function. War is lost or won chiefly upon the development of secondary sex qualities, and this principle roots deep and blossoms high.

VIII. *Woman and Morale*.—Never have women played such a part in war.¹⁰ We are told that in all the warring countries they

¹⁰ See IDA CLYDE CLARKE: *American Women and the World War*, N. Y.: Appleton, 1918, 544 p. HARRIOT S. BLATCH: *Mobilizing Woman-Power*, N. Y.: The Woman's

have done more work than men with munitions, food, especially the canned varieties, hospital and surgical appliances, and have also taken man's place in every peaceful industry. Her enfranchisement in many aspects of this great movement has advanced by leaps and bounds since the war began. It has also opened as never before the whole question of the relation of the sexes in all its aspects. The mobilization of woman power and its substitution for man power has given her an equal place in the sun. She will soon be able to cast a ballot and be a citizen in practically every country in Europe.

If, however, she had the opportunity to and could do everything as well as man, or better, and did not bring her woman's viewpoint into the new paths and functions now open, all this would mean nothing save doubling our lists of voters and workers. She would have won nothing if she did not realize and now say that the advent of her sex into industrial and political life must materially change its character and goal. Hence the vital problem in this her great epoch is to introduce the best traits of her sex into public and economic life.

Woman is nearer to the race in body and soul and is a better representative of the species than man. She is more phylogenetic than ontogenetic, more altruistic than egoistic. She stands for the future and the past and is charged with the interests of posterity in a very different sense and degree from man. The true woman ranks and grades every human institution according to its service in producing and rearing successive generations to an ever more complete maturity. We need to understand and appreciate in conscious plans what woman more unconsciously always and everywhere chiefly wants, viz., an environment most favorable for her great function of conserving and replenishing the race. Because she is more generic than man and more liable to be injured by excessive and premature specialization, she needs more shelter and

Press, 1918, 194 p. HENRY SPONT: *La Femme et la Guerre*, Paris: Perrin, 1916, 268 p. J. COMBARIEU: *Les Jeunes Filles Françaises et la Guerre*, Paris: Flammarion, 1915, 297 p. HELEN FRASER: *Women and War Work*, N.Y.: Shaw, 1918, 308 p. IRENE O. ANDREWS: *Economic Effects of the War upon Women and Children in Great Britain*, N.Y.: Oxford Univ. Press, 1918, 190 p. GERTRUDE ATHERTON: *The Living Present*, N.Y.: Stokes, 1917, 303 p. LADY RANDOLPH CHURCHILL, Editor: *Women's War Work*, London: Pearson, 1916, 159 p.

A student of this subject must give a prominent place also to the unique cult of Jeanne d'Arc that broke out in France some years before the war and has been greatly heightened by it. "La Pucelle" is now a national holiday in which the descendants of the very Englishmen who fought against France in those days now join (see in W. STEPHENS: *The France I Know*, Chapter XIV, The Cult of Jeanne d'Arc).

protection and responds subtly to everything of this kind. Hence it comes that if she is denied the normal expression of her basal instincts she is liable to become frivolous or anxious, or to immolate herself by becoming a slave or devotee to some cause, or to fall a victim to the many types of subtle invalidism to which she is so liable.

Thus the new post-bellum world should be more of a woman's world, not in the sense of the old matriarchate but in a way that will bring to her and her apostolate for the race a new reverence. These are the real woman's rights. It is thus her task to reëvaluate the world and all its institutions, business, trade, state, church, science, by the supreme test of their service in bringing future generations to an ever more complete maturity. Thus we must regard the voice of Ellen Key and those who agree with her as more or less oracular as to what woman needs, wants, and can and should try to do for the morale of this great reconstruction era.

When the war came, the noblest war brides, mothers, sweethearts, and sisters said, "Go!"¹¹ They condemned slackers ("If I had not gone I could not get near a girl"). Mothers wept, but secretly, and dared not to try to restrain their even young boys who felt the call, but sent them off with a blessing and a cheer. The best wives took up the struggle of self-support, perhaps accepting charity for the first time, and the best husbands and sons understood later, though some of them did not at first. Women kept up every possible connection between their dear ones at the front and their home, concealing everything that could cause pain and showing only courage and good cheer, disguising everything that was bad or discouraging, slow to criticize but swift to praise and hearten, and themselves bearing up if their loved ones were wounded, crippled, or even slain with a composure and heroism which none, least of all they themselves, dreamed they possessed. The reveries of a happy home-coming, dreams sometimes not to be realized, are often the chief consoler in hardships at the front, where home is idealized as nowhere else.

And now women must take up the burden of replenishing the earth, of making good the loss of the seven million dead and the far more partially incapacitated which the war has caused. The inequality of the sexes thus occasioned will soon be restored, for statistics show that in hard times more boys than girls are born.

¹¹ R. W. F.: *Silver Lining. The Experiences of a War Bride.* Boston: Houghton, Mifflin, 1918, pp. 45. *Boy of My Heart.* London: Hodder & Stoughton, 1916, pp. 221.

The war sentiment will now make it harder for healthy women to refuse wedlock and motherhood and to be slackers to this call, for the pains of war make those of childbirth seem small by contrast. For this service women must volunteer for we trust we shall never have drafts for motherhood, such as the bolsheviki now propose to decree. The revolt of woman, the organization of which has actually been attempted, against giving to the world sons who are going to be cannon fodder is not unnatural, for why should one rear children only to be sacrificed to the war Moloch world without end? But she now has more hope than ever before in the world to encourage her to face this chance, trusting that her children's children at least will be supermen of peace and make an end of war forever. It is the generals of peace now at the helm who ought to be inspired by the ideal morale of women to make a world such as she will count it her noblest honor and privilege to populate. If eugenics is to be the religion of the future women will be its priestesses, for the world a century or two hence will belong to those races and nations that bear and rear the most and the best children.

Perhaps the much debated *Ewige Weibliche* may now take more definite shape as the best embodiment of morale in the world. Anthropologists have told us much of the primitive reverence of the seer-like, intuitive, prophetic traits of women, and perhaps we might now properly lay a single tiny twig of laurel upon the grave of Auguste Comte for the place he gave woman in his *politique*. We can also recognize the deep human instinct that prompted the French revolutionists to make the cult of her divinity a religion, for as great upheavals of society throw men back upon first principles and lay bare the fundamental if unconscious instincts there is a profound tendency to make the more naïve soul of womanhood oracular because her soul, like that of the child, seems nearer to that of the great *Autos* itself.

The danger as the war closes is that women who have been so dazzled by its splendors that they are now rarely pacifists, when they find themselves in bitter competition for jobs with the homecoming soldiers whom they have idealized and who perhaps will be even more ruthless and unchivalrous toward them in this domain because the horrors of war have made them a little more callous, will be more or less disenchanted with them and with life.¹² The demobilization of the great auxiliary armies of women raises, therefore, the question of what substitutes for the excitements of

¹² MARTIN SECKER: *Women*. London: 1918. Pp. 128.

war-work they can find in peace, and what mitigations or consolations may be found in this new war of sex against sex. Is there not danger that each will to the other be robbed of some of the glamour with which war has invested them both in the eyes of the other? This would be disastrous not only economically but socially and would not be in the interests of wedlock or eugenics, nor indeed of morals itself. I can see no way of entirely avoiding this danger, which seems to me grave, but we can at least hope that the new psychology which is most opportunely at the door and which stresses the all-dominance of unconscious and affective forces, and which might almost be heralded as the advent of the woman's soul into psychology will in time mitigate this danger and slowly evolve a new atmosphere of appreciation and respect of woman's services in every walk of life, which will give her the spiritual *milieu* without which she is so prone to go to pieces. If in utilizing the new opportunities that suffrage in about all the warring countries brings to her she can make herself in this the greatest crisis in the history of her sex more womanly and not more manlike, she will, as the world slips back into peace, do most to make it a new and better one.

IX. *Morale and Placards.*—When at the outset of the war England was confronted with the problem of raising a vast army as quickly as possible the Secretary of State for War, Colonel Seely, called upon Mr. Hedley LeBas, a London publisher who had been deeply interested in the psychology and practise of advertising and who was allowed, not without much hesitation in conservative England, *carte blanche* to stimulate enlistment in any way. Some of the best artists were engaged, and a series of about one hundred and fifty posters were soon conspicuously displayed all over Great Britain with a message it was hard to ignore. All agreed that they were a prominent if not the chief factor in raising a volunteer army of over three million men. When and before recruiting was superseded by the draft the same method was applied to war loans, and by its aid over three billion dollars were raised in two weeks. In this country posters, beginning with those of the Marines, have played a great rôle, and many American artists, Blashfield, Kenyon Cox, Reuter dahl, Gibson, Pennell and others were enlisted. While our government issued only two posters for the first Liberty Loan, private organizations flooded the country in each drive. All countries have used them for Red Cross, food, the wounded, and indeed every war purpose.

Art in a somewhat stricter sense has also helped military morale by producing many notable pictures and especially series which have been very important factors. Raemaekers of Holland has made his art a potent factor for morale. He has produced hundreds of striking anti-Teutonic pictures so effective that the German government is said to have sought him so persistently that he fled to England, and he was charged with jeopardizing the neutrality of Holland.¹³ A few French artists have had immense influence and vogue, e.g., Georges Scott, who had followed the Balkan campaign as a reporter-illustrator and who was appointed one of the four official painters to the French armies; also Lucien Jonas, whose remarkable, sometimes allegorical compositions were, like those of Scott, executed at the front. Icart was the first to successfully introduce the airplane, which is a new and awkward topic for canvas. His *Spirit of the Air* and *The Defense of Paris* brought him into instant fame. Many of his pictures illustrated the relations of woman to war. Then there is Levy-Dhurmer, whose pictures are charming but sad, his best series being perhaps that entitled "Mothers of the War." Poulbot has a hundred pictures illustrating the effects of the war upon children.¹⁴ The French have used art more effectively than any other country for mutilated soldiers. They have also offered prizes to children for pictures, especially those concerning food in war-time.¹⁵

Thus the war has been a veritable inspiration to scores of artists, and by its aid they have brought home its terrible realities in all its details and have also brought out, perhaps even more effectively than poetry or music have been able to do, the ideality always latent in it. Not until the history of this great conflict has been written up shall we realize to what an amazing extent art has simply been the very incarnation of war morale. Many of these artists have already been decorated, and the end of the war by no means marks the end of their influence or of their work, which the briefest description of some of these masterpieces of emotional appeal, were there space for it here, would itself show.

Closely connected with this work has been the use of titles, slogans, and watchwords, in which the spirit of the war has also

¹³ Raemaekers' *Cartoon History of the War*. Compiled by J. MURRAY ALLISON N.Y.: Century Co., 1918.

¹⁴ *Des Gosses*.

¹⁵ Clark University has about 6,000 of these artistic war pictures, including proclamations. See the Librarian's report, *The War Collection at Clark University Library*, October, 1918.

been embodied and which are very generally, especially in the posters, connected with pictures. Every country has them.

Ils ne passeront pas.

Ne l'en fait pas; on les aura.

Go on or go under.

If you cannot give a life you can save a life.

Don't lag! Follow your Flag!

Picture of a bugler blowing. A vacant space in the ranks.

Legend: Fall In!

Soldier pointing to a beautiful landscape. Legend: Isn't This Worth Fighting For?

Soldier with a beckoning finger. An Appeal To You.

Picture of St. George slaying the dragon. Legend: Britain Needs You At Once.

A soldier: Make Us As Proud of You as We Are of Him.

Have you a reason or only an excuse?

You are proud of your pals in the army but what do they think of you?

How will you answer your boy who says, "What did you do in the great war?"

A gray-haired mother saying to her boy, "Go, it is your duty."

A picture of troops in battle almost overwhelmed. Legend: Why Don't They Come?

Picture of Whistler's "Mother." Legend: Fight For Her.

The O'Leary posters.

Picture of pretty Irish colleen pointing to burning Belgian house, and saying, "Will you go or must I?"

Columbia sleeping. Legend: Wake Up America.

Liberty Bell. Ring It Again.

Desperate battle in the background, Uncle Sam in the foreground with drawn sword. Legend: "Hold the Fort for I Am Coming."

If You Can't Enlist, Invest.

Don't Read History; Make It.

American girl in a middy blouse. Gee, I Wish I Was a Man; I'd Join the Navy.

Munitions being loaded labelled "Rush." Legend: Help Deliver the Goods.

Man of the signal corps wiwagging. Legend: He Is Getting Our Country's Signal. Are You?

A soldier on an observation post. Legend: The Country Is Looking for a Fit Man. Are You Fit?

French girl waving the tricolor over the sea. Legend: Come Across and Help Us.
 You Come Across or Germany Will.
 Boxing match between Uncle Sam and the Kaiser, who has just had an "upper cut." Legend: Be In At The Finish.
 Our Hat Is In the Ring; Come In and Put One On.
 Shall We Be More Tender With Our Dollars Than With the Lives of Our Sons?
 Daddy Is Fighting At the Front For You. Back Him Up. Buy Bonds.
 Shall We Conquer or Submit?
 A message from the front: When Are The Other Boys Coming?
 Picture of Germans plundering a cottage. Legend: Is Your Home Worth Fighting For?
 Three Soldiers playing cards in front of a dugout. Legend: Will You Make The Fourth?
 Are You Playing the Game?
 Obey Your Impulse Now.
 Telephone operator at the front calling, "We want more men." Legend: Will You Answer This Call?
 How Will You Cheer the Boys Coming Home If You Have Done Nothing?
 Picture of a soldier's cap. Legend: If This Cap Fits You, Put It On.
 Picture of jolly soldier with full equipment. Legend: Come Along, Boys.
 Picture of Lord Roberts. Legend: He Did His Duty. Will You Do Yours?
 A bare, muscular arm with clenched fist. Legend: Lend Your Strong Right Arm To The Country.
 Every dollar makes the Kaiser holler.
 Buy a gun to beat the Hun.
 Bondmen now or freemen forever.
 A man who won't lend is the Kaiser's friend.
 Liberty bond or Liberty bound. Which?¹⁶

The pithy epigram and the cartoon have done great things in the world but never greater than in this war. Years ago the Toledo fad, which for a time had quite a vogue, of posting a new cardboard

¹⁶ It is said that the German government early tabooed war pictures that represented doleful scenes, and required happy faces. Not many of these have yet reached this country but such of them as I have seen, at any rate, very greatly stress the festive side of war.

motto each day in school was thought to make the chief moral qualities percolate into the deeper regions of the soul. Christian Science has used this method with its health axioms. Calendars and card posters exhorting to primary virtues are issued now in series and are posted, with daily or weekly changes, in very many factories and in offices. These apothems are thought to be hardly less pregnant than Bible texts were once regarded, and they do have not a magical but a real psychological efficacy as morale-bracers. Posters of all kinds short-circuit books and newspapers, like the old broadsides, and a chapter might be written on posted proclamations in the war. Pictures find their way very effectively into the souls of even those who cannot read. These methods uncap impulses that may be made to spur men on to great decisions, while if the true function of art is to conserve ideality in the world and give to every act its best and not its worst interpretation we can realize that when war throws men back into the power of their primitive emotions such agencies as these may have all the challenge and arousing power of the most effective of the old battle cries and rallying slogans. It is true that these appeals may have precipitated decisions to enlist or give which were later regretted, and perhaps with good ground. As after revivalistic conversions men may backslide, so in soldiers the high tide that swept them into the army may ebb, but even in such cases part of their total self is committed for the war, and even in the worst cases it is better to have loved these great causes for a time and have lapsed from them than never to have loved them at all.

X. *War Aims*.—Sagacious men saw even before we entered the conflict the great need of setting before the minds of the public, and especially the soldier, just what we were fighting for. President Wilson has done perhaps his best service in suggesting these goals. The philosophers of idealism, like Hocking, criticize the attitude of, for example, Eltinge, who would rely more on unconscious, instinctive crowd impulses to give men the fighting edge. As a result of all this effort the mind of the intelligent soldier has come to realize more and more that we were the leader of the world's democracy, that we were fighting a war of liberation against autocracy and militarism, and there can be no doubt that the efficiency of our soldiers has been greatly increased by this general belief.

But specific, conscious aims belong rather to the preliminary or to the subsequent reflective stages of warfare, and on the ragged

edge of battle it is the momentum given by ideas which, while a very important factor, is of less consequence than impulses that spring from the instinct of self-preservation, pugnacity, gregariousness, our preliminary beliefs, the general set of the will, fear, anger, etc. Even the conscientious objector in the charge has to fight, and very few can stand out long against the all-compelling sentiment of the crowd.

It was perhaps fortunate for us that we did not plunge into the war more precipitately because all the time we were planning and preparing public sentiment was being educated and opinion was being formed by leaps and bounds, and this was the change that made possible our own wonderful achievements in the end. The war was so big, we were so uninformed about European conditions, our press had to undergo such an intensive self-education in order to meet the emergency that the problem of realizing what we were up against was a tremendous one. This education, however, has made us forever and in a new sense a member of the nations of the Old World. Our intellectual and even our material interests have undergone an enormous and unprecedented expansion. We can never return to our old blindness and provincialism. Even if the Monroe Doctrine is imperiled we are destined henceforth to be not only an integral but a leading member of the family of nations. Not only that, but Europe looks to us with a respect and a degree of newly felt dependence that no one could have dreamed of even three years ago.

It has been an inspiration at home and was a great and unpredictable factor in the European settlement that our aims were in a sense disinterested. True, we profited enormously by European contracts, and without doubt we would have supplied Germany no less freely had this been practicable. But the fact that we want no land, no indemnities, have given enormous sums and prepared our huge army and suffered our own share of losses, that it was all a free gift to a great cause, has elevated the morale of not only our army but of the country and of the world by a spectacle unprecedented in history. It is this that has given us an opportunity for a new world leadership which, if Congress and the press has the vision to see and to utilize to the uttermost, will be the acid test of their own patriotic sagacity. The problem before the country now is: Shall we enter upon this new leadership to which we seem to be called, and can we make ourselves worthy of it?

XI. *Morale and Conscientious Objectors.*—The fact that in the

present war Great Britain took action against barely one thousand genuine cases, and that such were numbered only by hundreds in this country is suggestive, for we are told that the paucity of numbers is an index of the clarity of conviction regarding the righteousness of the cause. While conscientious objectors generally meet with scant sympathy in army or camp, where they are often hazed, bullied, and outlawed by sentiment and in a few cases, we are told, have actually been killed, there are many, on the other hand, who have the adroitness and tact to be efficient as peace propagandists that make them very insidious enemies of army morale. The genuine objectors were exempted from active fighting early in the war by England, and religious objectors were placed in the noncombatant army service of this country by the President's order of March 20, 1918. The conscientious objector is unknown or not heard of, or at least has no voice on the continent, and is also of course unknown save under conscription. There are at least nine religious bodies in this country, of which the Quakers are best known (they have modified their attitude since the war began) whose creed makes them oppose war under all conditions. Tolstoi's example and influence in this direction, we are often told, had much to do with the debacle in Russia, and the objector conceives himself as in line with the ancient Christians, many of whom were ready to become martyrs rather than join the Roman legions. On the one hand the very theory of democracy favors the recognition of the right of private judgment, and respect of conscience is something too sacred to be interfered with, although conscription began with the French Revolution and through history has oftenest been practised by republics, autocracies preferring standing armies. Here, and far more in England, there has been much written on the subject,¹⁷ and many recusants who have been imprisoned have written up their experiences in a pathetic way, while there has been a deluge of magazine articles on the subject, some by high judicial and other authorities (like Prof. A. V. Dicey, Gilbert Murray, and W. R. Stather Hunt). Many hold that nothing will justify the state in compelling a man to do what his deepest convictions forbid.

On the other hand, thuggism and the suttee were inspired by religion, while at the other extreme today in several lists of conscientious objectors agnostics lead and there are almost no two

¹⁷ MRS. H. HOBHOUSE: *I Appeal Unto Caesar*, and G. G. COULTON: *The Case for Compulsory Military Service* (London, 1917) give the most convenient surveys.

socialist objectors who agree as to the grounds of their opposition. Socrates is well cited as a citizen who felt it his duty to die for the state if it so decreed. The law makes short shift with extreme Christian Scientists who refuse to employ doctors for dangerous diseases or with those who object on conscientious grounds to paying their taxes or to sending their children to school. The judgments of conscience are often erratic, and many crimes have been committed in its name. A French writer in a very sensational book justified the regicide Ravallac because in slaying Henry IV he was actuated by what seemed to him religious motives.

The most difficult matter, of course, is to determine in each case from the previous life and character of the objector whether his scruples are sincere. For every genuine case there are probably a dozen slackers, cowards, shirkers, and malingerers, and the convictions of those who have any are often superficial and extemporized. The examiners who test these cases sometimes have a hard task, though generally experience enables them to decide quickly and truly. Many take cover under religious creeds with which they are shown to have only the very slightest acquaintance, or claim Biblical grounds for their remonstrance when they know almost nothing of the Scriptures. Some are anarchists and against all governments, others are neurotics, but it is important for the morale of an army that all these pretenders, as well as the genuine cases, be at least unmasked.

One very simple acid test has been suggested for those who object to war as inhuman. They are asked whether they are willing to alleviate suffering and danger by working on mine-sweepers or as stretcher-bearers. Those who refuse these most dangerous functions can hardly escape the brand of cowardice as at least a factor in their vaunted humanitarianism. Some declare themselves ready to assuage the suffering of the severely or mortally wounded but not that of those who are less injured, because by their aid the latter may be enabled to become fighters again. A motley crew of these slackers have become refugees from all countries in a New York club, *From The Four Winds*, mainly fugitives from the English Defense of the Realm Act. To refuse all service in the Medical or Quartermaster corps, in engineering or railroad service because of these objections, and to take the twenty-eight days of solitary confinement and the added two months of prohibition to write or receive letters or visits, and to bear the contumely of the community rather than serve in a good cause would

seem to indicate that the objector has too much will for his intellect and lacks something of the gregarious or social instinct that makes a desirable citizen. One writer estimates twenty-five thousand real or pretended conscientious objectors all-told in this country.

To most the conscientious objector is a nuisance. He thinks himself a sufferer for conscience sake and so entitled to pity and respect. These kickers have brought the very name conscience into disrepute, and many think the preferential treatment accorded them is unpolitic. One suggests they should be made to read and answer the dialogue between Socrates and the Laws and also the end of the Crito. On the other hand, in the days of the Fugitive Slave Law and in very many other cases those who have chosen to obey their conscience by breaking the law of the land have been right. For fifteen months the objector could emigrate from England, and it was held that his refusal to do so implied acquiescence, because if his objection was not strong enough to induce him to make this sacrifice discriminatory treatment was not justified. In England it was found that there was very much money of suspicious origin spent in fomenting schools of objectors and persuading those who wanted exemption on other grounds that they might use this. Some interesting analyses have been given of a moral state in these *soi-disant* objectors which is clearly morbid. Some of them are psychically masochists and love to suffer and sometimes have sex abnormalities. Others are unstable and catch any fanaticism that is in the air, losing their sense of proportion and even their mental balance.

Thus the objectors are a motley crew. While the conduct of a few may suggest moral sublimity and heroism, the majority are imperfectly socialized and hyperindividualized, and because soldiering requires the subordination of each to the will of one command the presence of these in an army is always dangerous. They should be excluded from the army not so much out of respect to their idiosyncrasies or even their convictions as because they may become the most insidious of all the foes of morale.

XII. *Music and Morale*.—Why do psychologists who write on army morale never mention music, which is one of its most important adjuvants? Plato praised the stately Doric and the martial Phrygian modes and would banish from his ideal Republic the softer Lydian and other modes as enervating. This would practically exclude music of home, love, and nature. W. L. Spaulding gives us a glimpse of the ancient and medieval rôle of

music in war. A German Committee examined and rejected 3,200 compositions written in competition for a prize offered for a fit national anthem. So far this war has produced nothing that begins to compare with *Die Wacht am Rhine*, which has almost become a symbol in that country of the war of 1870, the spirit of which it so well conserves; or with our *Battle Hymn of the Republic*, which expresses the American militant spirit of our Civil War.

General J. F. Bell said: "A songless army would lack in fighting spirit in proportion as it lacked responsiveness to music. There is no more potent force for developing unity in an army than song." It makes a good soldier a better, and a trained soldier a more perfect one. We read how the ennobling war songs, *Sambre et Meuse* and *Père la Victoire* sustained the French at Verdun and elsewhere. Soon after we entered the war a national committee was formed, with F. Hammer at its head, to induce soldiers to sing. Soon every camp had its song leader, and a school for training these leaders was established in New York with H. Barholt, the noted leader of community singing, at its head. Conditions were novel, and new tracts had to be broken. A roster of musical ability was made out, and concerts were organized as well as regimental bands.

When Mr. Stiles first mounted a soap box at Camp Devens and demanded that every private and officer in the assembly show his teeth and smile as if this were a drill order, his hearers were taken aback at first and chaffed, but they soon found that he was a good fellow, could take as well as give banter, and in a short time he had them singing the chorus of *Smile, Smile, Smile*, and their troubles, for the moment at least, went into the "old kit-bag."

The answers of these song leaders to a questionnaire I sent them showed very great differences in repertoires and also in the favorite songs in the different camps, but all testified to a unique hunger for music as a feeder of the very soul and stressed its power to key up exhausted nerves and muscles. Altogether these reports gave overwhelming proof that music had become no longer a luxury but a necessity for the soldier. It is a great bracer on a long hike, "eyes brightened, shoulders straightened, ranks closed up," etc. It is the best safeguard against care, worry, and homesickness. Americans tend to hide their real feelings, but their love of jocularities and extravaganzas cannot resist the catchy lilt of such chanteys as *Long Boy*. Idiotic jingles, and sometimes endless rhymes like *Ninety-Nine Bottles Hanging on a Wall* may make them forget fatigue near the end of a long march. Often one group of soldiers

sings for a mile or two and then the song is taken up by another group, and this may go on for hours. Not only are great liberties often taken with both music and words but the latter are sometimes permanently changed. Perhaps the height of extravagance is reached in the many songs which tell what the Sammies will do when they get to Berlin or to the Kaiser, Hindenburg, etc., when they catch them. There are songs, too, of all grades of merit and a wide range of sentiment dealing with every petty detail of the soldier's life, which our doughboys so love to see in a musical mirror.

Some simple songs of perhaps low musical quality have made a very direct appeal to soldier morale. *Where Do We Go From Here* suggests deeds accomplished and a pressure for fresh demands for still greater deeds, along with a spirit of entire subjection. *I Don't Care Where They Send Me* indicates something like a fatalistic submission and obedience. *Keep the Home Fires Burning* brings a vital touch in memory with home and makes the soldier realize that he is defending his dearest treasures. *The Long, Long Trail*, which several leaders call the song of songs in their camp, sounds a note of yearning, fate, with an Omar Khayyam touch of pathos. *Over There*, and *Keep Your Head Down*, *Fritzie Boy* are psychologically akin to the menacing gestures and shouts of savage tribes working themselves up to the frenzy of attack. Before some of these even *Tipperary*, the unprecedented world song, has paled somewhat in popularity. In the collections of camp songs I have listed some two-score more which seem to me must contribute more or less both to unify and to fortify the soul of the soldier. Indeed the country owes a great debt to many composers of the second or third class of merit who have voiced the soldier's heart and helped to form his will. In some camps stress is laid upon having the soldiers join in community singing or, vice versa, in bringing the community to the camp for song. In France our boys have learned many songs of their Allies and have taught them their own songs, which has created a spirit of fraternity.

Of the five great themes of song,—patriotism and war, love, home, nature, and fun,—our soldiers are inclined to take patriotism for granted and are not especially fond of singing about it. Even *America* and *The Star Spangled Banner* are rather reserved for formal occasions, and are not often called for or spontaneously sung. A very different class of music is wanted about the camp-fire than is in demand during drill or outdoors, when music more

closely associated with action is preferred. Of these five classes, love of friends at home, especially sweethearts, leads. In all the history of war love has been a very fundamental note, subordinated, as it has to be, to the stress and strain of war; and, unlike Plato, modern military authorities have not thought it inimical to morale but a kind of compensation or vicariate for hardship and battle strain. I have not found a single American song that deals directly with going over the top. The mind of the American soldier evades this as something he never wishes to be reminded of until the emergency compels him to face it. Our soldiers, too, never sing songs of death of their own free will. Only a few religious songs have been popular, and half the great vogue of *Onward, Christian Soldiers* is due to the fact that it is an excellent march. The amount and degree of bathos that our boys relish would seem to have no limit.

Thus music for us has proved not so much an art as a bracer, and perhaps still more a diverter. Many old songs have survived; more so, as far as I can figure out, in England with its conservative tendencies than in any of the other Allied countries. Old songs are often mainly nuclei of sentiment and are charged with reminiscences vague but strongly toned with affectivity. They are dear to us because of their many associations, personal and national. Most Frenchmen who sing the *Marseillaise* remember that it was the song of the group of Girondists before the guillotine, which grew dim as each head fell into the basket, only one voice finally chanting it until the fatal knife ended it in the middle of a note. With us the old songs naturally prevailed at first because better known, and some still persist; and while certain folk songs and even old darky music have survived, as the war went on these have tended to be superseded by newer compositions. Dialect, songs with dances or that involve much dramatic action, perhaps with costume and impersonations have also had a place. Nicolai claims that war poetry and music are always of an inferior quality, but this war has been a prodigious stimulus to productions, at which classicism may be inclined to sneer but which, even if they are Philistine, get in their good work.

We shall never fully realize the importance of music for morale until we see clearly once and for all that psychologically music is par excellence the language of the heart, feelings, moods, dispositions, sentiments, emotions, and attitudes, indeed of nearly all our vast unconscious life. It is just as much so as speech is the lan-

guage of the senses and the intellect and, to a less extent, of the will. Music, then, is the organ of affectivity and hence deals with what is more intangible and imponderable, though often far more potent, especially to the group mind, than ideas or concepts. Even nations and races sing out their hearts and reveal in music their deepest and most characteristic traits. Incidentally it should be remembered that song gives voice to our young officers who often so strangely lack it, so much so that to Mr. Lloyd has been assigned the task of developing this use of it. From this its nature music ought to develop all the classes of sentiment and feeling, and indirectly it tends to strengthen the deeper, unconscious instincts men have in common and to fuse souls together.

French war music has some unique features. By the closing of the theatres and vaudevilles many Parisian artists who lived by the drama were in dire distress, and some of them became ballad singers in cafés and on the streets and squares, and acquired both vogue and profit. The Parisian was too tense to sit through a play but singers of both sexes wandered about, sang, and sold songs of their own composition. One noted soprano produced *The Marseillaise of the Dead*, which immediately had the greatest popularity. Very many incidents of the war have thus been cast not only into poetry but into song, like that of the boy of seven who was killed by a German because he aimed a wooden gun at him. Thus every sentiment connected with the war has been besung, and many of its tragic incidents preserved. Joseph Lee insists that music is one of the very first things to keep soldiers well in body and to maintain their morale at concert pitch, and thus the French have used it. Songs with a sectional appeal are less common in this country than in Germany.

The German soldier music has traits all its own. On the whole the Teutons are more musical and also fonder of harmony and part song. They have hardly a trace of the American passion for beating time or for ragtime. They are also too serious for fun. The Germans sing about death, which the American never does, and thrill at the very word "*Deutschland*." They put more *Gemüt* than *pep* into their songs. *Das Volk Steht Auf* describes in a thrilling way the awakening of the people as the storm of war broke over them, and how all became brothers and would die together if need be for the Vaterland. *Erhebet Euch von der Erde* was a trumpet call to the people to arouse, seize their arms, consecrate themselves to the fearful chance of death, and expect help from the German God.

Das treue deutsche Herz, Kein schönerer Tod auf dieser Welt, Du Deutschland, Des Kriegers Abschied, Des Seemanns Los illustrate, as their titles indicate, the serious, death-defying spirit of men terribly in earnest.

In the cultivation of music in the army we are unfortunately far behind. The late Major F. A. Mahan, in an official report in 1914 by order of the Secretary of War, said, "All over the world, save in our own country, the necessity of cultivating this force (moral force or morale) is recognized." He found us very deficient. Four years later General Pershing found our bands in France so small that they "failed to serve the purpose of a moral force on the morale of our troops at the front" and recommended (1) an increased personnel, (2) a larger and more logical instrumentation, (3) a consistent method of band training. To this the Chief of Staff responded, and we have now a United States Army Music School such as France achieved under the influence of Napoleon and which the British copied sixty years ago when their Royal Military School of Music was established. Generals Corbin and Bell have advocated singing also as a promoter of morale, and the chief of our army music school, Captain A. A. Clappe, has set forth its needs and functions in a masterly article.¹⁸

Of poems the war has produced a prodigious quantity in all lands. It is interesting to note that before the close of the second year the Germans had graded and given prizes for the best of some fifty thousand poems by the German children who attempted to woo the Muse of War. The Clark Library has several shelves of bound volumes of war poems, and a few, although of course necessarily premature attempts have been made to evaluate them and select the best. Both poetry and war stories have played an important role in morale, though probably far less than music.

XIII. *Reading and Morale*.—Every home camp has its library and librarians. After the first weeks, when the recruits begin to harden, they do considerable reading, and a year ago it was estimated that there were some 45,000 college men in the army.

From answers to a circular I sent to each camp librarian it is interesting to note that despite the surprising difference in camps fiction leads, with tales of adventure and mystery taking the first place. Kipling, Doyle, McCutcheon, O. Henry, Tarkington, Oppenheim, Haggard, London, Wells, H. B. Wright, Mrs. Barclay's *Rosary*, Hornaday's *The Man Who Became a Savage* are

¹⁸ Music as a Moral Force on Morale. *Infantry Journal*, March, 1919.

samples of favorites. Next to fiction comes the demand for books about France, the French language and literature, and for military subjects, including engineering. Camp examinations brought a call for other classes of books, and indeed literature of almost every type has its patrons. Only books for girls, indecent literature, and German propaganda were barred, and the drive of December, 1917, brought many gifts. Very little effort, however, was made to guide reading.

My suggestion was that each camp library provide books describing the conquest of America by Germany, to compensate somewhat for our distance and aloofness by bringing possibilities home to reënforce morale. The chief of these are H. G. Wells' *The War in the Air* (1917), focusing in the battle of New York; Homer Lea's *The Valor of Ignorance* (1909), describing a Japanese invasion of our Pacific coast; J. B. Walker's *America Fallen!* (1915), a very realistic story designed to check our confidence and *laissez faire*; C. Moffett's *The Conquest of America* (1916); T. Dixon's *The Fall of a Nation* (1916), a horrible tale of what might happen here if pacifism prevailed; H. Maxim's *Defenseless America* (1915); J. W. Müller's *The Invasion of America* (1916).¹⁹ While some of these works are highly imaginative, several of them are written with the coöperation of military and naval experts and describe events that the authors believe might actually happen, the idea being that perusal of works of this class would help us to realize how the French and Belgians do feel.

Soldiers read what others do, but with much difference. It is a good sign that poetry, especially Kipling, Alan Seeger, Tennyson, etc., are much in demand. Religious reading has been less than was predicted. The American Bible Society has issued in army and navy editions, since we entered the war, about two and one quarter million volumes of the Scriptures, but despite the injunctions of President Wilson and Ex-President Roosevelt to the soldiers to read it, there is a great difference of opinion as to how extensively this has been done.

Few read spontaneously to fortify their spirits either against the hardships or dangers of war; more to clarify their convictions of the righteousness of their cause. Hygiene, too, makes some appeal; but,

¹⁹ On the invasion of England see *The Battle of Dorking* (1871); DU MAURIER's *An Englishman's Home* (1909); E. CHILDERS's *The Riddle of the Sands* (1903); Lequeux's *The Coming of the Germans to England* (1914); REDMOND-HOWARD's *Hindenburg's March to London* (1916).

on the whole, the motive of diversion seems to exceed that of practical preparation.

Reading anything is a sedative. To feed the new interests aroused by entering a military life is a problem which the war did not last long enough for us to entirely solve, though we have realized its significant aid to morale. Just how and in what direction to stimulate reading under training-camp conditions is a new, vast problem which librarians have not yet solved.²⁰

XIV. *Morale and War Collections.*—The collection instinct, which is illustrated in the life history of many insects and animals and which is always strong and has often been studied in children, has found unprecedented expressions concerning this war. Many children and schools in all the belligerent countries, many of which already have their war cabinet of curios, have assembled relics and reminders, largely local, of all kinds of material illustrating altogether every phase of the great conflict both at home and at the front. War is such a unique experience that its conditions, sentiments, and activities tend to fade from realization like a bad dream as nothing else can do, for nowhere is the envisagement of full reality so intolerable; and there is a strong instinct, lest we forget, to gather relics and mementoes to keep it alive in our own minds and to ensure the perpetuation of its grim actualities for future generations. War museums of every kind are thus in a sense temples of morale and protests against its obliteration.

This is not the place to describe these vast activities in detail, but a few data will show their scope and their purpose. In the first days of mobilization Henri Leblanc and his wife began to gather objects in France, and their collection, now numbering nearly one quarter of a million articles, has been taken over and given elaborate and fitting quarters by the Ministry of Public Instruction and Fine Arts and its catalogue is being published volume by volume. England followed suit and established a national war museum under Sir Martin Conway, which is formulated on a very comprehensive plan. The great national libraries of Europe and a few libraries in this country have made special collections of war literature, but in all these fields the material is so voluminous that not only most private collectors but heads of great institutions have been discouraged, and it is now recognized that very much of this material is so fugitive that it is beyond reach unless it is gathered very promptly at the time. A really adequate assemblage of all

²⁰ T. W. KOCH: *War Libraries and Allied Studies*, N. Y.: Stechert, 1918, 287 p.

this material can never be found in any single institution or even in any single country. As early as August in 1914 the Imperial Library in Berlin set apart fifteen members of its staff to collect, sort, classify, and catalogue war literature. Agents were sent abroad to all countries, and patriotic appeals were made to private individuals the world over. Early in 1916 there were 10,000 books, and in a single day four and one half tons of newspapers arrived.

The French museum, which so far as objects are concerned excels all others, collects everything: firearms and projectiles of all kinds, uniforms, medals, insignia, postcards, war fashions in dress at home, illustrations of everything connected with feeding the army as well as home dietaries and food substitutes, trench journals, processes of manufacture and transportation of munitions and supplies, army wagons, transports, Zeppelins, airplanes, submarines, soldiers' letters, posters, slogans, knapsacks, grenades, minnewerfer, gas masks and generators, innumerable photographs of devastated regions and wrecked buildings, of atrocities, mutilations and corpse-strewn battlefields, flags, and scrap-books. Dolls and figurines are used to illustrate many processes. There is a department for camouflage and protective coloring generally, engineering, gas alarm gongs, trench signs, street-lamp shades to conceal from airplanes, explosive pencils, means of infecting the enemy and his animals with disease, infernal machines, bombs, devices for incendiarism and looting. Very complete is the representation of medical activities, pictures and documents showing all the marvels of surgery,—even the details of how features and parts of the face torn away are restored,—how to treat every kind of wound, artificial limbs, disinfection, uses of the Carrel processes and of the Dakin fluid, tents, and sanitary barracks. Sometimes the illustrations are by models but when possible the objects themselves are displayed. We have also a German plan which is hardly less complete, but I can find no data to show how far this work has actually been developed there.

Indeed the work of nearly all museums has been more or less stimulated and diverted. In museums of Natural History, for example, it is shown how killing birds that destroy noxious insects and weed seeds help the enemy, so that a boy who robs the nest of such a bird is a traitor without knowing it; for insects are as harmful as bullets. The same is true of keeping down rodents that destroy one hundred million dollars' worth of food here per year, and we may need liberty bonds to pay tribute to the mosquito, gypsy moth,

English sparrow, etc. One museum specializes on dye-stuffs, designs, native foods, and fabrics significant for war. Some have done research, others have invoked the aid of children. One attends chiefly to trade-marks, while there are many collections of cartoons.

The romance of war in the days of chivalry has gone, and the concept that dominates everything now is efficiency, which gives a new ideal even to art. It has been suggested that a rudimentary Westminster or Walhalla be established in every town or country, containing medals, portraits, and a vellum volume containing the name and the significant items in the life of every fallen soldier. This would be an epitome of local heroism, and would help to perpetuate the memory and influence particularly of those who have gone to a watery grave and whose bodies must remain unidentified. These would be perpetual incentives to self-sacrifice and would give zest to local history teaching.

The necessity of such collections for the future historian is obvious. The interest of the public in them is shown by the fact that admission fees to the Henri Leblanc collection in the Pavillon de Flore, it is estimated, will bring a revenue of some half a million francs a year. But their chief value for morale is that the very awfulness and unnaturalness of war tend to make its memory shrink and fade, so far as proper realization of it is concerned, to a degree that perhaps only a psychologist can realize. Today the world with one accord has swung over from the war fever to its opposite, and the desire for peace was never so strong. The function of these collections is to perpetuate this reaction by keeping the memory of all the ghastliness of war green, by keeping before the public mind what we owe to our soldiers, to whose deeds and sufferings such collections are one of the most fitting monuments, and to supply artists and writers of all kinds with details that would otherwise soon be lost. If, as some claim, human nature after a long period of peace tends revert to to a state of war, familiarity with these objects would tend in some degree to vicariate for the actuality of war, and, if it comes, would also tend to nerve the souls of our descendants to its hardships and vicissitudes.

XV. *Medals and Decoration*.—In the *Congressional Record*, July 12, 1917, we have the text of a law relating to the award of "medals of honor" to each person, "officer or enlisted man who shall hereafter in action involving actual conflict with the enemy distinguish himself conspicuously by gallantry and intrepidity at

the risk of his own life above and beyond the call of duty." In addition, this law provides for a service medal to be awarded by the President for distinguished service any time during the last three years, and this is to supersede the former certificate of merit. The service medal involves an added pay of two dollars a month, and for each additional deed of valor, instead of a new medal, the President may award another bar, each of which bars also involves two dollars a month.

In France the most coveted of all is the Cross of the Legion of Honor (1802) with a motto, "Honneur et Patrie," and with five grades. Besides its veteran's medal to those who fought in the war of '70, the French Croix de Guerre is given to all officers or privates for deeds of valor, especially on the battlefield (April, 1915). This honors even families, and there is a ritual form of conferring it and it plays a prominent part in funerals. It may be revoked for unworthy conduct. There is also a military medal (1852) for officers who have won distinction, which may be conferred in time of peace, besides many colonial and foreign medals (Sailard).

In England the war medal is comparatively modern and culminates in the Victoria Cross. But there are many types of medal given in all the important wars since these were established, some two-score in a l.²¹

Germany leads all countries, and since the sixteenth century there have been some 580 different varieties (G. F. Hill: *The Commemorative Medal in the Service of Germany*). Of all these the Iron Cross is the best known and most desired.²²

The Croix de Guerre has often been awarded to our soldiers in France, and General Pershing says, "Such recognition is a powerful incentive to gallantry in action, and American soldiers should not be denied the privilege of displaying these insignia of honor because of the old prohibition of accepting decorations from a foreign state."

It would seem that from every psychological point of view, and from the higher pedagogy, men who have deliberately risked their lives in desperate ventures for the public good should be recognized as belonging in some sense to the élite, for such deeds are only the culmination of morale. The world honors its

²¹ W. A. STEWARD: *War Medals and Their History*, London: 1915. Also H. T. DORLING: *Ribbons and Medals*, London: 1916.

²² HANS E. VON ZOBELTITZ: *Das Eiserne Kreuz*, Leipzig: 1914.

dead heroes; why not its living ones? What should also be done is to see to it that each sublime act of courage is duly and worthily recorded that it may exert its due and permanent influence. Such distinctions set a back-fire to the feeling often current among soldiers that their achievements are not sufficiently recognized and that the government lacks gratitude.

XVI. *Morale and Knowledge*.—The psychology of evidence, started experimentally by Binet and Stern and applied by many legal writers to testimony, shows how hard it is for the most honest observers to state accurately the most indifferent facts. Dramatic incidents prepared and enacted as a class-room exercise and described by onlookers are reproduced by individuals of the class with great differences, even in essentials, and where oral statements are given and reported by a series of persons they come back to their source with changes directly proportional to the number of minds through which they have passed. When strong emotions are excited facts are still more distorted, and rumors run very wildly, for the critical faculty is in abeyance and the mob mind often shows a credulity that is almost unlimited. The early stages of the war abounded in fantastic, sometimes almost panicky reports in all countries, especially during and just after mobilization when the public on the street was so eager for information that if it was not forthcoming it was supplied by the imagination, and sometimes suggestibility was so intense that delusions were common, as, for example, in the "angels at Mons," the apparition of which the English Psychic Research Society has found various witnesses who testified on oath to seeing. Many believe that 180,000 Russian soldiers were transported secretly by sea from Vladivostok to England and thence to France. The Germans believed so intensely that a yellow auto was going through their country from France to Russia loaded with money that such vehicles were stopped, and in a few cases their drivers were shot. Every stranger was liable to be suspected and even arrested as a spy, and in all the European countries warnings were issued against talking of the war in public. A long list of often preposterous tales won wide credence. In times of great excitement all are prone to believe what they wish, and overdrawn feelings tend very strongly to create if they cannot find facts to justify them.

As to press censorship, it passed through three rather distinct stages. Hundreds of correspondents with little preliminary knowledge of European affairs and sometimes of continental languages

were rushed to the scene of war and, affronted that military authorities weighed out all scraps of information to them as carefully as if they were diamonds, and as the American reporters especially were pressed by their home newspapers for "snappy stuff," they not only sought in every way to get by the censor but some became free-lances and a few yielded more or less to the temptations of fakerism. Some American papers exposed themselves all too justly to the charges of mendacity (F. Koester's *The Lies of the Allies*), and we had such headlines as "Eleven German Warships Sunk," "Kaiser Loses Two-Thirds of His Army in Poland; His Sons Escape in Airplane," "Von Kluck's Army Is Taken." This was the first stage of reporting, which ended about the time of the fall of Antwerp. Then almost with one accord the warring nations shut down on reporters and gave the public only their own very brief official reports, which the great news bureaus used as best they could. This W. G. Shepherd calls the period of the dark ages. In the third stage the reporter was allowed to live in a certain area and was given perhaps each day his daily bread of news at headquarters, and was also allowed to travel and see for himself within certain limits. But everything he sent had to be submitted to the official censor; if he attempted to evade this ruling he might be punished by dismissal. Thus military interests dominated his work and almost anything could be repressed. The reporter was no longer marooned but was silenced if he transgressed. By this method the British kept the first battle of Ypres a secret from the world for several months. The *Times* could not print for months the account of the first Zeppelin raid, although its own building was damaged. Thus the reporter in the later stages of the war was no longer a prisoner but was in daily touch with the War Office, could make almost daily trips officially prepared for him, often even up to the firing line, and so according to his own initiative could know and tell much about the front. The best of these reporters have educated themselves and the public very rapidly and well, and our leading dailies have grown in these four years vastly less provincial and more cosmopolitan, although there has yet been no concerted movement to gather news systematically by placing qualified correspondents in all the great centers of the world to give readers at home a preliminary sketch of history, which is everywhere now being made so rapidly. Thus the cultivated American might yet fervently use many of the phrases in Ajax's famous prayer for more light.

In Germany the military censorship of the press, which is always rigorous, became vastly more so at the outset of the war, and as early as July 31, 1914, a long list of forbidden subjects was published. Every few days military orders were given as to what could and could not be printed, and many papers were suppressed for various lengths of time, without a hearing, and perhaps the editor imprisoned or forced into the auxiliary service. Every governmental bureau has absolute authority concerning the publicity of its doings. The future of Alsace-Lorraine, labor troubles, hard living conditions, and war aims could not be discussed by order of the high command. Despite the constitution Reichstag speeches were mutilated, and some deputies had to submit their speeches to the censor in advance, without mentioning that they had done so. Separate peace with Russia was also under the ban. In addition to suppression and gagging there was much "inspired" material, which was standardized and which the papers had to print. The German journals were allowed to use only one version of the Jutland "victory," the Zeppelin raids, and Belgian deportations. News was also doctored; in President Wilson's address of April 2, 1917, half the text including "the world must be made safe for Democracy" was deleted by Wolff, and also the passages declining compensation and expressing friendliness for the German people. J. G. Randall has compiled many incidents of downright fabrication. The same items were served up differently for Belgium and Russia, and everything that happened or was said in all countries favorable to Germany was featured. Thus the German press in general has become since the outbreak of the war even more "reptilian" than Bismarck called it. All this is especially done in the interests of morale. The War Office decides what the soldier and the public shall know and not know, for news is a war asset that ranks next to munitions.

Another aspect of this subject is found in the systems of espionage and methods of getting intelligence as to the doings and intentions of the enemy in order to avoid surprise. On the one hand every purpose and movement is disguised in every way, and strategy consists largely in misleading the enemy; while on his side he must develop and use every possible agency to learn beforehand just what to expect, for only thus can the supreme disaster to morale in actual fighting, viz., surprise, be avoided. Thus it is that the successful spy is a hero on his own side but worthy of every indignity, torture, and perhaps death if he falls into the hands

of the enemy. André, whom Washington hanged in 1870, now reposes in Westminster Abbey. Captain Lody, after remarkable exploits, when tried by court-martial in Camera revealed all his instructions but not names, was loyal to the end, and said before he was shot that his trial was a model of fairness. Very few in this country and even in Europe before Paul Lanoir's book (and Dr. Burch's *Notebook, The Active Service Police in the War of 1866-70*, Walheim's *Indiscretions*, Zernicki's *Recollections*, and the famous Mesmard pamphlet of 1901) realized what this system meant in Germany. Even in 1810 there were 30,000 German spies of both sexes in France. Frederick the Great said, "I have one cook and a hundred spies." Spies in Germany are respected. They are of all grades and found in all professions. Men are entrapped by the Krausse houses, and Stieber (1818-1892), the originator of the present system, was a genius of originality and trickery. Everyone was watched, even spies themselves, and of course every court in Europe. Stieber was a friend of the king and of Bismarck, who called him "the great reptile." His agents secured the personal safety of the Czar at German spas, and allowed an assassin, whose plans they knew beforehand, to shoot at Alexander III in Paris; they then arrested him, as this procedure suited Bismarck's purposes. In 1866 Bismarck approved the plan of invading France in advance of the German army by introducing 4,000 agriculturists and 8,000 domestics, so that the road by which Moltke's army marched into France was strewn beforehand with spies, some 30,000 in all. Stieber studied each commander, the opinion of each district, provided in advance for the lodgment of the German army, working with children, the sick, and the poor, as well as with the press. He insisted that the German invaders were led by his army. During this Franco-Prussian War the expense of this secret police system was 783,000 pounds, a part of which was paid to strike leaders in France. Engineers, too, were spies, and at a signal disorganized traffic. They preyed upon every expression of industrial unrest, and made common cause with anarchists. Whenever there was a rumor of friction between France and Germany they fomented strikes, paid money for elections, worked with all kinds of parasites and wastrels and all who were "down and out," and provided sources of income for those in debt. Many were drummers, and some wore the ribbon of the Legion of Honor. Jules Favre in 1870 engaged Stieber himself in disguise as a servant. These spies are sycophants, money-lenders, they are found in every

drawing-room, and have a system of letters innocent on their surface but every phrase of which has its key for interpretation. Stieber claimed that the conquest of France in 1870 was due more to his pioneer work than to Moltke's army. Germany now spends more than a million pounds a year for this secret service. The system has lately spent most of its energy in Russia with results which the world knows.

The remedies are, first, a growth of public opinion based on realization of the danger; also a revision of laws. The allied nations have contented themselves for the most part with detecting and punishing spies and have not generally approved the development of a counter system of espionage. None, so far as known, has organized a scheme in Germany like that which the Germans have developed in other countries for it would not be thought honorable by public opinion and would conflict with our national ideals of morale. It is due to this system in Germany and its almost total absence in England that the latter was so taken by surprise and was at a disadvantage at the outset of the war, so that the lives of many thousands of her best young men were lost. On the whole we cannot escape the inquiry whether as we had to meet gas by gas, submarines by submarines, we should not also have henceforth secret agents in Germany to keep our authorities informed, far more intimately than our press is able to do, of what is actually taking place there. If this wounds our national honor we could console ourselves with the fact that our active espionage would be entirely in the interests of preparedness and defense and not with a view to offensive action.

The mails have been a very effective war weapon, and to examine them is to discover and frustrate the enemy's plans, restrict their supplies, and impair their capacity. Some letters favor acts of violence, such as incendiarism and sabotage, others deal with the supply of vital material, while a third class is connected with propaganda. It is as necessary to check espionage as to forestall seditious literature. In England every twenty-four hours thirty to fifty thousand telegrams pass the censor and some four hundred cablegrams. Many of these letters are in code, and a vast body of useful information has been gathered by these "eyes of the blockade" and also, what is no less important, withheld from the enemy. In London the censoring force numbers 3,100. It was a new institution and so Liverpool founded a training school for these experts under Colonel Tody, which handles nearly 400,000 items

in twenty-four hours. The postal censorship service costs England \$3,350,000 a year.

Another great department is to shape and influence public opinion by means of propaganda. This, like espionage, is very elaborately and very expensively organized departmentally in Germany, which has spent millions monthly in Russia and the story of which in other allied countries has been so successfully unearthed and checked. This is not the place to describe in detail its methods, which are of profound interest to psychology.²³ Every device has been resorted to. New books have been bound in old covers and under misleading titles, leaflets and even forms have been inserted in purely scientific books and journals so that the importation of all these into this country has for two years, we think unwisely, been held up from our universities and libraries by England. Seditious articles have been printed in some of the papers and in many of the journals in this country which are printed in a foreign language. In the vast censorship museum of Great Britain are thousands of objects illustrating these arts of getting by. Special systematic attempts were made to stir up the natives of Java, Sumatra, and Singapore.

In the official Bulletin of February 4, 1918, we find the scope and activities of Mr. Creel's Committee on Public Information, which goes to our 30,000 papers. These, with no compulsory censorship, have so marvelously responded to a gentleman's agreement to print nothing of advantage to the enemy, such as troop movements, defenses, and embarkations, that we have had almost no official press censorship. Our bureau has sought chiefly to influence public opinion at home, among our allies, and also with the enemy. It has used many million dollars' worth of free space for advertising, prepared and used movies, has had an airplane service to distribute circulars behind the lines, and for all these activities has only two hundred and fifty paid employees, for there are five thousand volunteers and several times that number of

²³ See, for example: HORST VON DER GOLTZ: *My Adventures as a German Secret Agent*, N. Y.: 1917, 288 p. A. K. GRAVES: *The Secrets of the German War Office*, N. Y., 1914, 286 p. LEON DAUDET: *L'Avant Guerre*, Paris, 1915, 312 p. LOUIS ROUQUETTE: *La Propaganda Germanique aux Etats-Unis*, Paris, 1916, 154 p. HAMIL GRANT: *Spies and Secret Service*, London, 1915, 320 p. THEODORE ROOSEVELT: *The Foes of Our Own Household*, N. Y., 1917, 347 p. WILLIAM H. SKAGGS: *German Conspiracies in America, from an American point of view*, Lond., 1915. ROGER B. WOOD: *The German Spy in America*, Lond., 1917, 256 p., with an introductory note by ex-President Roosevelt. *The German Spy System in France*. Tr. from the French of Paul Lanoir, 1910.

public speakers. It has issued a few pamphlets of very diverse quality, and in addition to its Division of Syndicate Features has one of Foreign Language Newspapers and also of Photographs.

From these very bare and large outlines we can see that in war times the control of news is a factor of inestimable significance for morale. In the trench and at home the soldier, especially the American soldier, as well as the citizen, craves to know just what is going on, and if he is left in ignorance, tension and fear are harder on him than the envisagement of even bad news. If he believes that he has been really told the worst and that nothing has been kept back he is satisfied; he can pardon many things easier than concealment of facts he feels he has a right and ought to know, and if he is surprised by something utterly unforeseen he is liable to lose his balance. He has amazing power to adjust and react efficiently in any situation that he can clearly see, however desperate it may be. Just as the democratic world is now demanding the abolition of all secret treaties, so the soldier demands to be taken into the confidence of his officers and to glimpse the larger strategy in which his unit is called on to play its part. Psychology can realize even more fully than democracy is yet able to do not only the negative side of the dangers of reservation and concealment but the great positive accession of energy that comes where the soldier feels that he participates in knowledge not only of the facts but of the purposes of the high command. To be told beforehand that there is grave danger in an enterprise, and to be shown something of its reasons and relations to the success of a plan goes a great way toward giving him the nerve to carry it out; while a sense of ignorance is felt to be a kind of mental asphyxiation. Thus officers are revising old ideas and recognizing noetic needs and realizing their value. There are already those who believe that more, even if informal, talks should be given on all suitable occasions and that by circularization troops should be put in the possession of as many bald facts as possible, leaving them to draw their own inferences and form their own opinions concerning everything that the intense curiosity of the trenches seeks to find out. The public and the peoples of the world, as our President is now telling us, must be taken more into the confidence of governments. Legitimate criticism must not be repressed but welcomed. No doubt reticence, as Lequeux says, has often saved from disaster almost equal to that of the black week in the South African war. One of the greatest calamities in the war of 1870 was caused by a French

journal which said MacMahon had changed the direction of his army. Through England this reached Moltke, who altered all his plans and captured MacMahon and his army at Metz. This was an awful price for the indiscretion of a newspaper. But the public must not be spoon-fed, for either optimism or pessimism, if kept blind, is dangerous. The full story of the first battle of Ypres, which was so long withheld and distorted, would probably have done a great deal in England for recruiting, for great disasters as well as great victories rouse the British to greater efforts. Spying in war is not like stealing trade secrets or inventions or any other kind of industrial espionage. Perhaps, as some claim, the means of acquiring secret knowledge has progressed faster than the arts of concealing it, and if so this is suggestive for those who wish to prophecy. On the whole we must conclude that although this subject fairly bristles with anomalies, in the new era we shall have a rather radical revision of our conceptions here in favor of more openness and less concealment, both to the soldier in the ranks and to the public.

XVII. *Differential Morale*.—Differential psychology takes account of individual variations. No two people are exactly alike in body, and they are still more unlike in mind and character. The same is true of nations. Even patriotism is a very different thing in different lands. It generally contains at least the following ingredients: (1) love of landscape, soil, and the physical environment, which plays such a rôle in ethnography; (2) race, especially its more generic differentiations, white, black, red, yellow; (3) language including much that is common in culture material and in modes and expressions of thought and feeling; (4) *mores* or the general body of national customs and habits, including food, drink, and attire; (5) a common history and traditions, as, for example, Renan called the ancient Jews the people of the Book; (6) political institutions like the state or governmental institutions, with always something thought to be more or less divine about them,—whether it be a direct supernatural force, as in a theocracy the divinity that hedges kings, an embodiment of absolute reason as with Hegel, or in the *vox populi* of democracies; and (7) economic interests, such as in China are now being made the new basis of unity, or as the German confederation of Bismarck started with the tariff union. There are many more factors, of which these are the chief.

Now all of these influences are cohesive except the last, which are dispersive, and it is on these latter that all internationalism from

Marx to Bolshevism are mainly based. Most economists tend to internationalism and, in so far as they do, are unpatriotic. Commercial relations bind nations together, but at the expense of their integrity. Business as such knows little of patriotism but has long made it its pretext, striving to use the flag to make trade follow it while, at the same time, erecting tariff walls, issuing embargoes and checks on immigration or freedom of movements of men and countries. The proportion of the other six elements and their innumerable components differs indefinitely in different countries. So much is this the case that there is not so very much that is common between the love of country which an American feels and that which goes by the same name among Englishmen, Frenchmen, Germans, Japanese, etc. Indeed the patriotism of perhaps no two men in the same country is identical. The same is true of morale, both in peace and in war.

Such national and temperamental differences have a salient illustration in the diversities of stress laid upon these characters in both the training for and the practice of war, of which we see perhaps the most convenient contrast between the Teutons and French from Clausewitz and DuPicq down to Bernhardt and Foch. The Germans study fortifications, maneuvers, movements of army units as if war were a game of chess, and have developed their very elaborate *Kriegspiel*, which is heralded as marking a pedagogic revolution somewhat analogous to the methods of case study in law schools.²⁴ They figure out the details of time, numbers, and munitions, and the effects of the mechanical impact of bodies of men. Their strategy is that of a game planned in detail beforehand. The French theory and practice focus on the attack and charge, and it is to this that everything diverges and from it converges. The moments that precede the charge in which, we are so often told, every soldier, whatever his religion or irreligion, offers up a prayer or its psychological equivalent are the center of all interest. The core of the whole matter for the German is thus the *Gemüt* to fight in general, while for the Frenchman it is the *esprit* of dashing at the enemy and stabbing him down or compelling him to flee. Here, too, the English are strong but without much theory about it. In these crucial moments each group or individual must act for himself as the emergency directs. The officers can only give general directions and inspire by personal leadership in front rather than issuing orders from the rear. Details thus have

²⁴ M. W. MEYERHARDT: *The War Game. Ped. Sem.*, Dec. 1915.

to be left to the inspiration that the moment brings to each. In these two ways of war all the heredity, history, and diathesis of the Gaul and Teuton respectively are expressed.

Again, as Huot and Voivenel²⁵ tell us in a remarkable work approved by the War Ministry, courage is the triumph of the instinct of social over that of individual preservation. It is the sacrifice of the self for an ideal. It is the acme of citizenship. In moments of desperation and abandon it comes like an inspiration, even to mediocre men. The last vestige of fear goes, death is accepted as certain, and this sets free new and terrible energies; indeed it is often just at this stage that the most heroic deeds are done. The whole strength of the race nerves the individual, so gregarious is man, and before the inevitable end he is impelled as by a higher power to do one supreme act of service. But who can tell whether the noble Americans who died in and for France,—Victor Chapman, Norman Prince, Kiffin Rockwell, Alan Seeger, and others,—evolved a clear ideal, which few really do, or followed the blind all-compelling social impulse. And who shall say which is highest or best. The Frenchman often loves his country as if she were a woman, *avec une pointe de sexualité*. Love of it seizes and carries him away as love of woman sometimes does a man. Just before the battle there is intense tumescence; every nerve is taut. Then there is a great hemorrhage of sentiment, and afterward comes exhaustion and depression.

XVIII. *The Soldier Ideal*.—The ideal soldier comes perhaps nearer being the ideal man than does the ideal workman, scholar, farmer, savant, or the ideal man of any other occupation. The soldierly attitude and bearing is the acme of alertness and readiness for action of any kind on the instant with a maximum of efficiency. Man is the erect stander (*anthropos*) and the soldier's very posture suggests the goal of human evolution, for he is the most upright of all men, and this suggests that he is supercharged with vitality. His uniform must seem to fit him and suggest that he would strip well. On parades and in civil life his dress must be immaculate and he must be spick and span in every way and part as well as in his toilet, while his every movement must speak of vigor. The true soldier carries a certain atmosphere of tonic, out-of-door healthfulness and life abounding that is a mental and physical tonic to all he meets and is the very opposite of weakness, invalidism, or flabbiness. There is no sign of apathy or accidie about either his

²⁵ *Le Courage*. Paris: 1917, 358 p.

body or mind. The ideal soldier is not merely an erect man in uniform with a gun or sword but a man of sentiments and ideals peculiar to his calling. Honor, which is simply ideal conduct though often codified into fantastic form, is his Muse. This rule of life, though somewhat more pagan than Christian in its origin, is more positive and more ideal than the puritanical rule of conscience and demands more superfluity of virtue. It is all of duty with a large plus. It makes a strong appeal to the youthful imagination, and is in fact the very best standard of human behavior in every relation of life. It has every predicate of Pauline charity and then some. The true soldier does not have the heart of a thug with a brain steeped in modern *Kultur*. Let us, however, be just and admit that the old German band of virtue (*Tugendbund*) in which young men, many of them lately soldiers in the Napoleonic wars, united to cultivate in civil life the primitive virtues of the camp, such as fraternity, utter honesty, love of work, loyalty, righteous pugnacity, and mutual help, to which they added chastity and the penitential mood, was in its early prime a potent agent in regenerating Prussia when it reached its pinnacle of cultural development a century ago.

The true soldier surpasses all others in team work and *esprit de corps*. This means that he has learned to execute orders on the instant and with exactness, to keep in the closest *rapprochement* with his fellows, and that he has voluntarily subordinated himself to the group with utter abnegation and has made its aims his own. He can thus be handled in larger groups and each trusts in the next highest command, thus avoiding friction and enabling vast bodies of men to act as a unit. He has developed a large bundle of useful habits acquired by prolonged discipline that are for his own and for the common good. Thus the very manual of arms and all drill are not in themselves the best liberal education for the body compared with modern physical training which gives the fullest of all-round development to every muscle and every movement possible to the body as a machine. But it is superior to this latter because drill movements are the very best of all group activities for training the muscles and the will, of which they are the organ, to the most strenuous of all efforts, viz., overcoming the enemy. They are sanctioned again, most of them even in their details by the experience of ages, some of them going back to the primitive hunter from whom the warrior developed, and also by the consensus of the competent since the history of war began. Their benefit extends even to the details of military etiquette. The salute to the

petty officer is to him, to the staff, and, back of it, to the state. The salute to the flag is not a ritual addressed to a piece of striped bunting but to the country and the cause of which it is a symbol. The ceremony of mounting guard comes down to us from the Crusades and was once an act of religious consecration. Presenting arms expressed offering up of self and weapon. Bugle calls, taps, military funerals, and the rest are not a few of them made up, warp and woof, of symbols.

Least of all can a soldier live to or for himself. He and all that he has, is, can do, his entire *thun und haben* are subordinated as a means to an end that vastly transcends self. He must be, feel, and act like a soldier, that is, for his companions, the army, and his cause. For this reason he should also be a gentleman without fear or reproach and should feel himself particularly called to elevate and advance to ever higher levels the loftiest ideals of his sex, a call which the instinctive admiration of women always and everywhere makes to him. While cultivating hardness to the enemy he must and will naturally compensate by more tenderness to friends, the weak, defenseless, sometimes even to animals. The very drudgery and sordidness of camp and trench life make him seek compensation in ideals of home and of peace. As the war lasts on and he grows grim and fatalistic, and his will becomes set as if in a tonic cramp to see it through regardless of self, countervailing suggestions arise that all the suffering and battle must be paid for by a world enough better to make up for all he has gone through.

Thus the complete soldier and patriot has unprecedented incentives to idealism and to be more ready to insist on and enlist in all great and good, even if radical, reforms. If he has found in the aims of the war a cause that is so much greater than himself that in his heart he has really consented to die for it if need be, the awful school of war will graduate him a man more fully statured than others who have lacked this supreme initiation to life. He can show "a healthy brisket," that he has "grown hair" on the chest not only of his body but of his very soul. Would that more soldiers might go on to this higher diploma of finished manhood and citizenship, and not stop at the kindergarten or primary stage of the soldierly curriculum!

XIX. *Carrying on the War After Peace Comes.*—Many if not most great wars have been followed by periods of dis- and reorganization, lawlessness, and greed, and there is a very great danger that this will be the case, perhaps especially in this country, now. It

will surely be so unless the new vigor and robust virtues that war has given us are kept up in a new war with the weapons of peace. As Harold Goddard well says, "Without the new health, hitting force, adventure, loyalty, justice, and high endeavor that the war has bred peace will mean stagnation and decay." Even physical vigor is just as essential for the battles of peace as for those of war. We must make justice a passion, realizing that not only is the world not yet safe for democracy but that democracy is nowhere more than half realized and is as yet only an ideal toward which we its leader have taken but a few steps. So the soldier who is a hero in the struggle of arms often becomes a moral coward, intent only on personal indulgence when he comes home. To do this would be ethically worse than desertion.

Every intelligent and impartial mind recognizes that in this country Capitalism is a danger no whit less than Kaiserism or military autocracy, and unless we can devise and commit ourselves to a substitute for war against its abuses, the struggle begun with powder and gas will be unfinished.

What we have to do is to devise effective means of setting a back-fire to the principle of the Soviet, but more specifically, of Bolshevism, and this we can do only by the method of inoculation with an attenuated virus. Russia today by her propaganda for a cause, the devotees of which however mistaken are ready to sacrifice their lives, is waging a post-bellum fight which will be far more significant to the world than anything she ever did with her arms. In our better cause we should realize that if we are to maintain our world leadership in democracy we have to make ourselves far more democratic than we are, and reorganize our very industrial system from bottom to top.

War inevitably leads men's thoughts back to first principles, and everywhere thinking men are reconsidering social, political, industrial, and even family traditions and institutions. Everything bottoms on industry, and even in the Non-Partisan League, which has so much to commend it, we already see a suggestion of the Soviet principle which animated the ancient guilds, that cities, and states should be ruled by real representatives of the different lines of industry, which should be so reorganized that the present greatest of all wastes in our political system, viz., friction between Capital and Labor and unfair competition, can be forever and as effectively wiped out as we have almost wiped out the old and wasteful warfare between Science and Religion. When the work of the

Paris Conference is done and political boundaries and balances are agreed upon, the hardest of all the wars against the future war should be the chief concern of the country and the world. There must be no bolshevik domination by the proletariat, and indeed there cannot be save in Russia where the middle class, which was weak in France in the days of the French Revolution, is almost non-existent. A true democracy will never commit itself to the foolish principle of the equality of men, save in opportunity. Individuals differ enormously,—in ability, in capacity for service, in the value of the hereditary strain that flows through them, and in everything else, as well as in the kind of ability that comes by training and education, and any political, social, or industrial organization that prevents superior men from attaining superior rewards is doomed to failure. The history of this country, especially since the Civil War and indeed long before that, is a triumphant vindication of the principle that the freer men are the less equal they become, and while here the chief measure of ability has so far been too much material reward, the instinct of competition which prompts everyone to do and be the greatest and best he can needs only regulation. Interference with it will always bring not even mediocrity but inferiority and stagnation.

The present, then, in fine is the most critical moment in the history of this country and the world. Never were there such possibilities of advance or regression, nor such need of mobilizing all our moral resources for the new militancy of peace. We owe this to the dead that their self-immolation be not in vain; we owe it to our descendants that they be really free; and we owe it to ourselves that we awake to the tremendous issues now pending, for even men of today are but a link between the past and the true overman that is some time to be. Thus the real problem of morale which is up to us is to face the Here and Now, to act aright in the living present, and to inaugurate a higher history of mankind compared to which all human records to date are only prolegomena or a preface.

We entered the war to make the world safe for democracy but we did far more; we made the world democratic. Thus our relation to these new republics is very like that of a parent to the children he has brought into the world. Shall we disown our offspring and leave them orphaned and unprotected? They owe their new life to us. We cannot expose them in their infancy. It is they now and not us, as we were in Washington's day when we were only a belt along the Atlantic, that need to be safeguarded from entangling foreign

alliances. Without our aid these new democracies will not be safe and our war-aim will be aborted. They will not all be our mandatories, perhaps none of them, but we are called by every principle of honor to be at least the "big brother" of all of them. When as a result of our Civil War we set the slaves free, we did not leave them at the mercy of their former masters but did our best, mistaken though our way was, to establish them in their new freedom. We cannot, of course, do this for the newly emancipated peoples of Europe, although they are free solely because we brought victory to the Allies and they know that we gave them their new life, but we can cherish toward them the same goodwill and do something to activate it. To evade this high duty would be moral slackerdom unworthy the spirit with which our soldiers fought and won.

The new democracies look to us not only because we made them free or because we were the first great republic, but also because they have made us by contributing so many of their countrymen, friends, and relatives who have come to these shores. Indeed we are all only and solely immigrants from Europe, or their descendants, and this our country, which is really "New Europe," owes all that it has and is to "Old Europe" and we shall probably in future years owe it a far larger debt of this kind. We have made a notable beginning toward paying this debt by our arms, and we must not repudiate the other larger moiety of it that is still due. It is a great debt with long accumulating interest. Europe is our father-or mother-land, and as it ages it may yet more need support from its young and lusty child across the Western sea. From our previous isolation we are now called to a new world leadership. The last becomes the first. Have we the morale to see this new opportunity and to assume the new duties and responsibilities which the Muse of History now lays upon us?

THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES.

COMPARISON OF THE SEXES IN MENTAL TRAITS

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To give this review a satisfactory title has not been altogether easy. It is the custom of the BULLETIN to publish from time to time summaries showing the results of experimental investigations in which the sexes are compared in mental traits, and the present review is intended to perpetuate this custom for the years 1916-1918. To entitle it "Sex Differences in Mental Traits" would lead the reader falsely to infer that all or most of the comparisons have shown differences. To call it "The Mental Traits of Sex" would imply that it discloses mental traits which are sex-limited. On the other hand, a title like "Sex Identity in Mental Traits" would be unfair, especially to such expressions of opinion as are to be included, which take the time-honored view that there are, and must be notable, inherent psychological differences between the sexes. Simply to adopt for a title "The Psychology of Sex" would give the erroneous impression that the review treats of literature pertaining to the sexual instinct. The title finally chosen seems to circumvent most of these difficulties.

From the standpoint of the experimental behaviorist no conclusions should be noted in a review under this title, except such as were based on the quantitative study of large numbers of both sexes, selected at random, or on exactly the same basis. And any difference found between the two groups thus selected and studied, could be announced as a sex difference only if it reliably exceeded the probable error of the average or median; or, being within the

probable error, was found constantly to occur in a large number of comparisons of similar groups with each other. Furthermore, a reliable difference thus found could be called an *inherent* sex difference only if it were shown to be present when the training and environment of both groups had been similar. The only point in pausing thus to state the obvious is that investigators sometimes neglect these principles of scientific method, and announce any difference found between two groups, arbitrarily segregated on the basis of sex, as a "sex difference." They forget that a chance difference would be found if the individuals composing the groups were re-segregated on the basis of any incidental factor—say eye-color or presence and absence of freckles.

The reviewer who would confine himself exclusively to results gained by the experimental method outlined above would, however, automatically tend to do himself out of his review. He would have very little to report. It was formerly a kind of convention among psychologists to include in the summary of results of a study where both male and female subjects participated, a paragraph on "sex differences." There seems now to be a growing tendency among those who have studied individual differences most extensively to omit this customary paragraph. For instance, Pintner and Pater-son (14) make no reference to sex differences in their recent standardization of performance tests. On the basis of the extensive data from which his *Mental Survey* is derived, Pintner (16) states merely that "sex differences in these tests are too slight to justify separate norms for boys and girls." In the standardization of the picture completion test, Pintner and Anderson (15) say, "the test is equally well adapted to boys and to girls." Pressey and Pressey (17) postpone discussion of sex differences for a later paper.

Two comparisons of the sexes in memory tests have come to notice: E. F. Mulhall (13) tested 285 boys and 353 girls for recall and recognition, with various kinds of materials. She found that "for memory of words and syllables the averages are slightly higher for the girls, for forms slightly higher for boys," and that "there appears to be no marked sex difference in variability." A. I. Gates (5) from tests of adults concludes that women show slightly better performance than men in memory, and that men are slightly superior to women in reasoning. The amount of overlapping and the reliability measures are not given.

Marsh (11) presents results on two individuals, a man and a woman, who subjected themselves to a long fast, during which

mental tests were administered in order to detect possible changes in performance and feeling. "The sensory and passive sides of the self are not greatly affected, generally speaking, but sexually show male sensitivity for pain and perceptivity for dots increased, and for touch decreased; while for the female the reverse is true. Some improvement for both sexes is shown in mental clearness and accuracy, though not decisively; and a most pronounced effect upon the memory, disadvantageous for the male subject, and advantageous for the feminine. The feelings, usually acute for several days, and then usually apathetic for a time, were on the whole ambiguous indices of the grades of objective performance, less so for the male than for the female." What justification there could be for entitling such a study "sex differences" is hard to see, since it includes but one man and one woman, each of whom might easily differ as much or more from others of the same sex, as from each other.

The experiments of Berliner (3) with æsthetic judgments of school children, made on 180 girls and 180 boys of grammar school ages, show that "the ranking of a group of pictures is to a high degree the same for both sexes"; that "different groups of girls agree more closely in their æsthetic judgments than groups of boys"; that "the average positions of the pictures differ more from one another in groups of girls than in groups of boys"; that "inside the group the girls agree more closely in their æsthetic judgment than boys"; that "boys agree more closely in their dislikes than in their likes; girls agree more in their likes than in their dislikes,"—a result contradictory to results previously announced by H. L. Hollingworth and by E. K. Strong, Jr.; and that "the variability between the extreme and middle pictures tends to be greater in groups of girls than in groups of boys."

Rosanoff, Martin and Rosanoff (19) in extending the studies of free association previously undertaken by Kent and Rosanoff and by Rosanoff and Rosanoff, have made special comments in comparison of the sexes. They state that "all conditions being approximately equal, no difference is found in the showings of the two sexes, as regards our most significant measure,—the sum of 'high standard' values; but male subjects show very consistently a tendency to give either individual reactions or common reactions having no 'high standard' value, where female subjects furnish failure of reaction instead." They state also that "a tendency to give individual reactions or common reactions without 'high standard'

value, where normal subjects fail of reaction, seems to characterize neuropathic subjects, independently of sex."

Terman (21) and his collaborators have now published in monograph form the data from which The Stanford Revision of The Binet-Simon Scale is derived. Here the curves representing the performance of the two sexes are seen to be practically identical. No sex differences in variability appear. The conclusion of the authors is that the norms for general intelligence apply equally to both sexes.

Elizabeth E. Farrell (4) reports statistics from a survey of certain ungraded classes for children of exceptionally low mentality, in New York City. In these classes there were 258 boys and 103 girls. The investigator comments as follows: "The fact that more boys than girls are found in these ungraded classes permits of explanations other than that of greater variability in males. One of these is based on the fact that boys have greater freedom, are less restrained. Because of this they come into conflict with their school environment. This maladjustment makes it imperative that some notice be given to them, and some explanation sought." Race (17) selecting pupils for an ungraded class of superior children in a city school system, found 10 boys and 11 girls who were eligible on the basis of exceptionally high intelligence, and physical fitness.

In the field of animal psychology Bagg (2) has contributed a quantitative study of individual differences in the performance of white rats, which reveals no sex differences.

Turning from conclusions based on quantitative data, we wish to note recent expressions of theory and opinion, bearing on the behavior of the sexes. These are mainly discussions of the psychological considerations involved in the changing social status of women. Hull (7) has published an article pointing out the implications of psychoanalytic concepts in the study of the behavior of women and girls. The concept of hysterical and irrational reaction as the result of chronic blocking of strong, fundamental conations, by taboo, social suppression, economic nonentity, and the like, is brought to the attention of those who would understand the efforts of women to find another "place." In this same vein are chapters of Adler's work (1), published some years ago, but not translated into English until recently.

Moxcey (12) has written a readable book, based with discrimination on the data of psychology, and intended for those whose work has to do with the guidance of adolescent girls. L. S. Hollingworth

(6) has advanced the theorem that the traditional division of labor between the sexes implies no sex difference in mental traits; that it is to be explained solely on the basis of sex difference in the physiological function of reproduction, which has always bound the female to the house and offspring, leaving the male relatively free vocationally; that the traditional division of labor is what we should expect to find, even though there were no sex differences in mental traits.

Russell (20) expresses the belief that the concept of maternal instinct has been greatly overworked, in the service of social control, and that women will become increasingly resistant to exaggeration of its importance as a determinant of their careers. Jastrow (8) is convinced that "the feminine mind" is a type, different qualitatively and quantitatively from "the masculine mind," and has again presented his opinions in a chapter of his recent volume, *The Psychology of Conviction*. Wells (22) occasionally implies the existence of sex differences in instinctive equipment, as when he discusses work trends and mastery trends in connection with the masculine pronoun, and parental trends in connection with the feminine pronoun. On the whole, however, the reader is left to infer that the mechanisms of adjustment work independently of sex.

It is quite certain that not all the literature which compares the sexes in mental traits, and which would deserve comment, has been seen by the present reviewer. For example, publications have appeared under titles which would imply that they contain such comparisons, by Lipmann (9) and by Lombroso-Ferraro (10) respectively, but they have not been accessible to the reviewer. Now that the war is finished, foreign contributions will doubtless begin to become available once more. They are conspicuously absent from this report.

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THEORETICAL ETHNOLOGY

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The theory of a worldwide diffusion of cultural traits, which Graebner brought so prominently before the ethnological public about a decade ago, has been most vigorously championed of late years, though in a different form, by the British anatomist Elliot Smith, who has founded what may be called the Manchester school of anthropology. His most recent publication (9) presents a complete sketch of the origin of human civilization and an exposition of the psychological factors that operate in its evolution. The principle of psychic unity which has played so prominent a rôle in anthropological speculation is definitely abandoned. All cultural similarities must be the result of borrowing, for the phenom-

ena of civilization are regarded as so artificial and arbitrary that, failing specific human instincts for their creation, they could have sprung into being only once by sheer accident and then been disseminated over the globe from this place of evolution. The great center of dispersal, according to Smith, was in Egypt or at least in its immediate vicinity. More particularly are the features of New World culture derived from the ancient civilizations of the Old World. While these views have found but little acceptance among professional ethnologists, outside of his immediate entourage, the tremendous influence which Smith ascribes to the forces of tradition rather than to hereditary factors in the history of culture cannot fail to strike a responsive chord.

It is indeed from appreciation of the power of tradition that ethnologists continue to issue declarations of independence against other branches of learning. Rivers, for example (7), denies that psychology can furnish principles of interpretation to the student of social phenomena in the sense that physics or chemistry can supply such principles for the geologist's use. Answering Westermarck's objections that such a social phenomenon as the blood-feud can be explained only by the psychological phenomenon of "revenge," Rivers points out that in Melanesia this interpretation breaks down, and in the case of head-hunting purely religious sentiments take the place of a desire for retaliation. In order to understand the individual Melanesian's reactions it is necessary to understand his social environment. "In place of asking, How can you explain the blood-feud without revenge? I would rather ask, How can you explain revenge without a knowledge of blood-feud? How can you explain the workings of the human mind without a knowledge of the social setting which must have played so great a part in determining the sentiments and opinions of mankind?" From a somewhat different angle the autonomy of cultural studies is reasserted by Kroeber (5). The development of civilization out of merely biological processes represents a saltation to a different plane, that of the "superorganic," which henceforth evolves independently of any organic substratum and can no longer be investigated by the methods of mechanistic natural science.

A *rapprochement*, though hardly as yet an *entente cordiale*, is recently noticeable between psycho-analysts and anthropology. Freud's articles on incest rules and various social observances among primitive tribes, which originally appeared in *Imago* (1912-1913), have been assembled in book form and during the past year

published in English guise (1). Although the interpretations given are hardly palatable to the ethnologist, the volume contains a lucid exposition of two important concepts, the *Œdipus* motive and ambivalent emotions, and may stimulate the independent testing of their validity in the light of ethnographic data. While Freud approaches these anthropological facts from the point of view of the medical practitioner, Rivers has the unusual qualifications of a trained physician who has specialized for years in ethnological research and has latterly had occasion to apply psychoanalytic treatment in connection with war work. In a paper already reported on from another viewpoint (7) he draws attention to the great importance of the subconscious in social life. There is here a distinct parallelism between the individual and social mentality inasmuch as ostensibly introspective statements as to motives of thought and action represent nothing but an intellectualistic gloss over the real unconscious sentiments involved: they are rationalizations or, as American ethnologists would say, secondary interpretations. Quite recently he has published a lecture especially devoted to analogies between dream life and various manifestations of the cruder cultures (8). This essay differs from corresponding attempts by the Vienna and Zurich schools in that attention is not confined to a consideration of myth but embraces various other aspects of culture. Thus, symbolization is illustrated by the representation of an absent child by a coconut and this case likewise parallels the dream process of condensation, since a whole series of associated ideas is stenographically represented by the fruit. In corresponding fashion Rivers finds analogies for displacement, dramatization, and secondary elaboration. The upshot of the argument is summed up in the statement that the mechanism by which the dream-thoughts find expression shares its general characters with those which have produced the rites and customs of savage man.

In a very different sense a connection between ethnology and psychology is attempted by Haeberlin (3), who demands that the principles of primitive art be studied "by methods comparable to those applied in the æsthetics of our own." Hitherto the stress has been placed too largely on matters of ethnographic moment. The time has come to view the primitive artist not merely as a type but as an individual, to inject the biographical factor into this line of research.

Goldenweiser (2) has materially modified the conception of

totemism outlined in his previous contributions to the subject. While he was formerly inclined to minimize the content of totemism and to emphasize the formal factor, he now insists on the specific content. The distinctiveness of the phenomenon lies in the association of this content with a clan system, which differentiates it from the otherwise comparable phenomenon of religious societies. Totemic complexes uniformly "partake of that specifically socialized supernaturalism which is particularized in the varying clan contents."

Another subject of perennial interest relates to the processes of social evolution. Hartland (4), in an attack on Swanton's and Lowie's views, has taken up cudgels on behalf of the traditional theory that patrilineal descent has been uniformly preceded by a system of matrilineal reckoning. This conclusion he tries to establish by examining African, American, and Australian data with the aid of the method of survivals. In a rejoinder (6) Kroeber points out the North American data which have led cis-Atlantic anthropologists to argue in favor of a very different sequence from that postulated by the classical school. According to the American point of view a loose form of organization preceded exogamy, and patrilineal reckoning of descent was prior to matrilineal institutions. This is borne out by the fact that the lowest tribes culturally are uniformly non-exogamous, while the agricultural peoples almost regularly share a clan system.

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PSYCHOPHYSICAL MEASUREMENT METHODS

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Cowdrick (3) compares the Weber-Fechner law and the function of Fullerton and Cattell as to closeness of fit to data secured for the Sanford weight experiment. In general the experimental data fall between the two sets of values found by means of the formulæ. 89 records made by 48 observers were utilized. 46 of these records were made with no previous practice, the remaining 43 followed 1, 2, or 3 sortings. In the "no practice series" the Fullerton-Cattell formula gives the better fit. In the series which followed practice the Weber-Fechner law gives results closer to the data. Goodness of fit is defined in the sense of the method of least squares, and the magnitude of the sums of the squares of the deviations is used as the measure of closeness of fit. The fit is poor by either formula if the low terminal point of the four equal sense distances is included. The importance of studying the validity of the Weber-Fechner law with longer practice series is stressed. The data utilized were Cornell Laboratory records ranging from 1906 to 1917.

Hoisington (7) studies the effect of practice on the two point limen and upon its precision. The experiential data were secured by A. M. Palmer and P. R. Dickinson, who entered the national Service. 200 series were taken on each of two subjects. The 200 series were divided into successive groups of 25 series each, of 50 series each, and of 100 series each. No practice effect was discernible for the limen, but there was an increase in precision. Fifty series sufficed to give a difference between the limens of the two subjects with "96 per cent. probable correctness." In the case of one of the two subjects the closeness of fit of the Phi-Gamma function increases markedly with practice.

Langfeld (8) investigated the finger-span limen by means of special apparatus consisting of 6 Starrett calipers with suitable mounting and accessories. The six subjects were given a preparatory training, involving about 700 judgments each, in order to reduce the disturbing effects of practice. The method of constant stimuli was employed. Judgments of "larger, smaller, and equal" were utilized and degrees of confidence of "*a*, *b*, or *c*" were accepted. Doubtful, no-difference, and or-judgments were classed as of con-

fidence "*d*." The subject was forced to make guess judgments in the case of the "*d*" judgments, but they were not used in the main computations. The phi-gamma hypothesis was employed, the constants being determined by the method of least squares. The measure of sensitivity was found to be about 1 per cent. of the standard distance for thumb and forefinger, that distance being 5 cm. Successive presentation of standard and comparison stimuli to one hand, the right, gave results slightly superior, perhaps, in sensitivity to successive or simultaneous presentation to both hands. There was a positive association between right and wrong judgments and degrees of confidence. Right answers predominated in the case of forced judgments. The forced judgments were associated with a passive, involuntary attitude. The investigator recommends that subjects of psychophysical experiments be trained in this attitude.

Boring (1) gives a graphic and verbal elucidation of the relation of the phi-gamma function to the curve of error for the benefit of elementary students. For purposes of simplification a binomial expansion of low degree is substituted for the probability integral.

Fernberger (5) replies to Boring in the discussion concerning the number of observations necessary for the determination of a limen.

Burt (2) studied the illusions of movement resulting from two successive tactual stimuli. Blunt pointed brass rods controlled by solenoids were used as stimuli. By means of a time sense apparatus and suitable resistance, the duration of application of the points, the interval between applications, and the intensity of application were controlled. Four subjects were used. They were not informed as to the expected result. A control for the perception of movement was provided. The results correspond in a very interesting and suggestive way to those of similar experiments with visual and auditory stimuli. A tendency to reversal of the illusion is found to exist when the second stimulus of a given pair is the more intense. The illusion seems to be most pronounced when the relation between the distance apart of the two stimuli and the length of interval between them is direct, *i. e.*, if greater distances accompany longer intervals. The optimum relation between intensity and distance is also direct, but that between intensity and length of interval is reverse. The investigator finds confirmation in these results both for the central origin theory of the illusion and for his own action theory.

De Camp (4) concludes from his experiments that there is only a relatively slight influence of color of objects upon their apparent weight. Hue is considered to be effective independently of tint value. The apparent weights of a series of differently colored blocks of equal physical weight were obtained by three different procedures. These were (1) the method of paired comparisons, (2) direct serial arrangement, and (3) the selection of an equivalent weight from a graded series of weights all of a single gray. The agreement of the different methods was not close. The experimenter expresses preference for the method of paired comparisons on general grounds, but does not refer to the experimental studies bearing on the point. On the basis of results secured by the method of paired comparisons he states that there is a tendency to judge a red or black object to be slightly heavier than a yellow or blue object of the same weight. While the reliabilities of the differences previously mentioned are apparently very slight, the differences between apparent weights when sight only is used seem to be well established. Blue and black are judged to be the heaviest, yellow and white lightest, red and gray to be intermediate. There is no apparent relation between the affective value of the different colors and their weight as estimated by lifting.

Curtius Müller (9) presents an interesting paper, mainly historical, on errors of observation in the estimation of subdivisions of the scales on geodetic instruments. The writer lists a number of problems demanding investigation and asks for the cooperation of psychologists and physiologists in their solution. Müller reports an experimental study of his own on the relation between errors of estimation and the size of the scale intervals employed. The distances to be measured were the intervals between lines scratched on a metal plate. 8 scales with subdivisions giving field dimensions from $\frac{1}{2}$ mm. to 100 mm. were employed, the divisions of a single scale being uniform. Each of 8 observers gave 256 judgments. The subjects were chosen at random from students of geodesy and included some experienced observers. A comparator was used to check the accuracy of the judgments. The judgments were estimates of subdivisions of the finest intervals on a given scale. For fields varying in size from 1 mm. to 100 mm. Müller found that the errors of observations were on the average approximately proportional to the field size, *i. e.*, the relative errors were constant in magnitude. The relative error was higher with a field of $\frac{1}{2}$

mm. Eye strain and mechanical difficulties prevented the use of smaller fields.

Grabfield (6) reports a study on another subgroup of psychopathic subjects. The faradic limen by the Martin method was determined for thirty cases considered to be in the psychoneurotic group. In general the subjects exhibited normal æsthesia, some may have been hyperæsthetic. The finding is expected to have diagnostic value in differentiating this group from other groups which show an hypæsthesia to faradic stimulation. Some cases of traumatic neurosis and occupation neurosis did not exhibit the tendency of the psychoneurotic group as a whole. It is to be hoped that Dr. Grabfield will publish his complete raw data for all of his investigations or the reliabilities of the differences between the various groups he has studied.

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SPECIAL REVIEWS

Les Émotions et la Guerre. Réactions des individus et des collectivités dans le conflit moderne. M. DIDE. Paris, Alcan. 1918. Pp. 276.

This book, written in the trenches and in neuro'logical centers at the front and in the interior by the author of *Les Idéalistes passionnés*, brings together experiences and reflections of considerable

interest and value. It is divided into three parts, the first treating of war shock, the second of the egoistic, and the third of the altruistic types of war psychosis. Throughout the author aims at showing the superiority of affective forces over rationalistic constructions and in the first two parts contests the view that organic lesions are responsible for such mental disorders as he claims to be curable by psychotherapy.

One notes at the outset his definition of emotion as related to affective tone. By affective tone he means, not the simple algedonic qualities, but that state of euphoria, plenitude, or, on the other hand, of insecurity, apprehension, which the individual possesses, independently of any actual stimulation, as a sort of personal and hereditary equilibrium. Emotion is defined as "the intimate reaction of the individual with regard to the solicitations which tend to break up this mean affective tonality." This opens a wide field of application.

Dealing with the physical effects of explosions the author is of opinion that they rarely, if ever, occur through concussion of the air alone outside the zone of bursting material. This he confirms by his personal experience and by observation of cases following heavy bombardment. Apart from physical injuries physically produced shell-shock is functional and probably never the cause of permanent disorders of the nervous centers. Cases which appear to favor the contrary opinion are found on examination to be susceptible of interpretation.

Not all mental disturbances occurring during war arise from its operations and fatigues. The psycho-emotional reactions that do thus arise are psychic inhibitions and connected disturbances of memory. Psychic inhibitions are distinguished by either a minimum or a complete syndrome; the latter shows various types, the most pronounced being characterized by onirism reproducing most often the tragic or horrible scene which immediately preceded the hypnogenic shock. In both the lighter and the severer cases cure is effected by the breaking up of the actual emotion and the substitution of other emotions, or by setting free a desire, hope or passion. In general the methods employed are those of the professional hypnotist, aided at times by a strong dose of galvanization substituting a physical pain for the hypnogenic emotion. The disturbances of memory are distinguished as amnesias of fixation and amnesias of evocation; in the former attention is fixed on the memory of the tragic experience, in the latter all or part of the life

at the time or before the accident is forgotten. The *amnésies parcellaires* are the most curious. Prior to the war, we are told, a few cases were reported and admitted with some reserve; there is now no doubt of the facts. Several cases are cited.

Taking up the theories of battle psychoses the author discredits the "commotional" theory, with its assumption of organic disturbance, for cases where the phenomena exhibit only temporary interruptions of function. He also doubts the universal applicability of the strongly supported theory of autointoxication accompanying traumatic oniric confusion; he inclines to think that reflexes of a purely psychological character usually suffice to explain the observed disorders, without, however, denying the possibility of secondary toxic infections, or even of authentic toxic mental confusions. He approves the theory of emotional shock first formulated by Ballet and de Fursac in 1916 and adopts the view which assimilates the consequent phenomena—psychic inhibition, hyperemotivity and hyper-activity of imagination—to the phenomena long since observed and described under such terms as hypnosis and somnambulism. He cites his own personal experience in confirmation. He regards the hypnosis produced by emotional shock—and this occurs not only in war, but in other great catastrophes as well—as genetically a defence reaction, like natural sleep, whose function, according to him, is primarily prophylactic against exhaustion and fatigue and only secondarily for the elimination of toxins; it is comparable to the so-called "death shamming" of animals, but is ill adapted to the conditions of modern warfare and found chiefly among novices.

But war psychoses are not only those of shock; besides the hypnotic type, there is the hysterical type and there are other allied types. Dide uses deliberately and, as he claims with definite meaning, the abused term hysteria. It imports, according to him, a fixed affective tendency, but in a manner subconscious or unconscious, favoring a dissociation of the personality and characterized mainly by unconscious instability of affectivity. He enters a plea for a return on this subject to the classic French psychology as over against the school of Kraepelin. Of hysterical psychoses having direct relation to the emotion of war cases of the recidivist type, the permanent cure of which is always doubtful, are distinguished from the rarer cases in which the hysterio-emotional psychosis is prolonged. The characteristic of war hysteria is the absence of affective systematization. The permanence of the

symptoms is due to the fixity of the subconscious element which supports it. Break this up by a substituted emotion, and the other symptoms—amnesia, dysmnnesia, the tendency to live on dreams, etc.—disappear. These cases, however, must be carefully distinguished from others in which analogous manifestations are sustained by a defective intellectual factor or by an egoistic systematization due to tendencies of self-justification (*revendication*). This psychological method of discriminating physiopathic and hysterical disorders has interesting practical and therapeutic consequences.

The sustaining element in many cases in which there is no organic injury but which do not yield to suggestion is the cowardice of the patient, his aversion to pain, and to this is usually added congenital mental debility, which is quite compatible with a certain intuitive finesse, and this debility is often supported by a syndrome of motor debility. Thus an arm held motionless for a long time remains paralyzed, a limb or some part of the body which has assumed a special attitude to relieve the pain remains contracted. Paralysis or contracture thus induced may affect the motor area of the cortex; steady prolonged suggestion approaches in its effects the sudden amnesic or dysmnestic phenomena of hysteria. This variation blends with the *constitution revendicatrice* familiar before the war; the soldier thinks he has done enough and should now be allowed to retire, and in this he commonly receives the sympathy and support of his friends. With this passional egotism hysterical psychopathy may incidentally mingle. Dide discusses in detail the two main features of these physiopathic syndromes, the fixed antalgic attitude and the trophic and vaso-motor disturbances, emphasizing in regard to the latter his view that a phobia of pain, and sometimes a state of mental and motor debility, favors functional incapacities which suggestion, created by a habit, systematizes. Moreover, if immobility (*e. g.*, of an arm in a sling) produces ankylosis of the articulations, the concomitant inertia produces an ankylosis of the mental activity.

Finally, there is war neurasthenia. Many symptoms have been wrongly attributed to local lesions which really depend on a diffuse reaction identical with that connected with emotion. The mechanism is different from that in hysteria, different, too, from that of the *revendicateur* whose egotism withdraws him from danger, but a more passive and diffuse yielding leads to essentially the same result. Neurasthenia may be constitutional and start spontaneously, but moral traumatism may become a proximate cause with a minimum

of predisposition. Contrary to what might be expected Dide found in his own experience only a small proportion of hereditary and personal degeneracy among those suffering from great emotional disturbances due to the war. The conditions of war are so different from those of ordinary life that they can to a large extent modify ancestral tendencies. A normal individual may appear degenerate, an unstable degenerate may become a hero. Moreover, emotion is not the sole factor in acquired emotivity; overexertion is also a factor, and the case is cited of an officer promoted to a high command at Verdun who signed a paper testifying to his own incompetency after severe and conscientious labors. The neuro-psychic asthenia of war approximates all the manifestations of cortical fatigue. Emotion plays a capital rôle, a special predisposition favors its expression. The cardiac affections often found in these cases cannot be assimilated to those of hysteria, but are due to exhaustion and emotional causes. Those associated with head-wounds depend, it is held, not on the cranio-cerebral lesion, but on a post-traumatic neurasthenia.

A chapter of special interest to the practitioner, but of less immediate importance now that the war is over, concerns the way the functional troubles of war should be treated. It warns against false cures and the mutability of the symptoms, urges speed and decision of treatment in a suitable milieu, that is, near the front and not in the interior, and in general follows the lines of the psychotherapy of the French neurological school which, the author says, has made it possible to return a large proportion of the mentally injured to the army. This part of the book concludes with a characteristic French diagnosis of the collective psychopathic criminal egotism of Germany.

The third part treats of the altruistic passions. Egoistic and altruistic sentiment, both individual and collective, have a common origin in the instinct of conservation, the one negative, pessimistic, the other expansive, optimistic; to the need of perpetuating his physical being man adds the need of moral superfluity, luxury, irradiation. Most important for its influence on expansive tendencies in the troops is the affective psychology of the officers in command; the officer must inspire enthusiasm while preserving full lucidity, he is the reflex center of regulation for his unity. But his mentality is not rigidly confined to one type. The expansive tendencies in the troops are made up of many elements, such as the sense of discipline, esprit de corps, songs and laughter, the sense of duty to the collectivity, patriotism, religion, hatred of the enemy,

which together combine to form a social instinct of expansion sufficiently powerful to repel the solicitations of the instinct of conservation. These factors operate variously. For example, the religious sentiment is said to be rarely dominant, yet it is undoubtedly an aid to the believer in the performance of his military duty; but among simple souls the question is oftener one of superstition, connected with blessed medals, scapularies, etc., than of faith. As to hatred of the enemy, it is more a negative sentiment; the soldier fights to reach the assigned objectives and not from hatred of the soldier opposed to him; but victorious, he is capable of every violence.

Heroism reveals an affective tendency elevated to the sublime. The author's discussion is based on accredited facts, but runs out into somewhat vague speculation. He finds that the heroic act commonly represents an irresistible activity, sometimes an inhibition, *e. g.*, suppression of all external manifestations of pain and grief; at times the heroic attitude is sustained through a series of decisions and acts in which the instinct of conservation is in conflict with that of sacrifice; then, again, in certain high examples, tragic renunciations are involved. The impulsive type is found on occasion associated with degenerate impulsive tendencies, a case in point being cited; with regard to heroic inhibitions, the question is raised whether they may not be related to the phobias. Heroic impulses that are not degenerate are often found among the simple, the heroic inhibition is habitually the appanage of men of rank and culture. The irresistible quality in the impulse is analogous to that of the suggestion in an imperative command; "our instincts are the resultant of suggestions of an infinite past." The speculative conclusion finally reached is that heroism is derived from the genital instinct, whereby it is also related to æsthetic and religious inclinations, which, according to the author, have a similar origin. "At the basis of all sublime renunciation exists a little of the *amour féminin* and often even the unconscious tendency to render oneself worthy of all desires." The author goes so far as to suggest an analogy between the sexual act which assures the perpetuation of the race and the self-transcending sacrifice of the warrior impelled by the forces of destiny and symbolizing the nation's need of life.

A final chapter, parallel to that on the egotism of Germany, gives the author's interpretation of the altruistic motives inspiring France and her Allies.

H. N. GARDINER

SMITH COLLEGE

An Enquiry into the Analytical Mechanism of the Internal Ear.

THOMAS WRIGHTSON. Appendix on the Anatomy of the Parts Concerned, by ARTHUR KEITH. London: Macmillan, 1918. Pp. xi+254.

This is an important contribution to the theory of the functioning of the internal ear, and one which appears to administer the *coup de grâce*, if such were wanting, to the long held resonance theory of Helmholtz. While disproving on grounds of mechanical theory and anatomical discovery that resonance is the principle that underlies the stimulation of the auditory nerve receptors, the present theory is not founded on the idea of the telephone receiver. The idea which it promulgates and attests is rather one of *displacement*, as made familiar to psychologists by Max F. Meyer, and to some extent by ter Kuile. Although the complete presentation of his views bears a recent date, we are informed that Wrightson's contributions on the subject were begun over forty years ago. For full understanding of the painstaking investigations instituted and carried through by the author during these years of patient inquiry, as well as for the anatomical corroboration furnished by the illuminating research of his collaborator, the reader must be referred to the book itself. Here we may content ourselves with a brief statement of the theory.

The improvement over Meyer's conception of displacement is attributable largely to Wrightson's discovery that a single pendular wave affords four distinct stimuli to the auditory mechanism. These correspond to four phases of the wave-form: first at its rise, second at its crest, third at its point of crossing the base line (nodal point), and fourth at its trough. With the aid of a mechanical device for plotting compound curves Wrightson demonstrates by a method of counting that if we take these four phases into consideration, there occur periodic changes to account not only for the simple tones, in accordance with Fourier's law, but also for the combinational—both the summation- and the difference-tones. Transferring this complex of stimuli to the internal ear, it is shown that the basilar membrane responds in like fashion to occasion in the cilia of the nerve cells *transverse* movements corresponding to the four phases with periods of quiescence between them. The movements of these hairs set, according to Keith, in the jelly-like substance of the *tectoria*, furnish a discretely tactual mode of stimulation to the nerves which may in turn be synthesized or analyzed by the cortex.

The theory appears to be adequate for all the chief points on which the Helmholtz theory has relied for its support. The mechanical principles are worked out with refined nicety by Wrightson's expert engineering technique, while Keith's experimental research upon the anatomy of the organ makes clear its evolutionary adaptation for the purpose at hand. The only serious omission that a student of recent psychological literature on hearing may detect at a cursory view, is an explanation of the attributes of auditory *volume* and *brightness*. Both authors explain the gradual widening of the basilar membrane towards the apex of the cochlea as adapted for lessening the resistance to intensive impulses. Keith, at least, recognizes that high tones are more specifically involved in the action of the basal end of the membrane, while low tones bring more extended portions into play; but the reason of this might be made clearer. The possible association of wider stretches with increased volume, and the brightness of pitch in tones, as compared with the dullness or roundness of vowel-sounds, are subjects the authors do not consider. Yet these and similar questions are not without a promise of solution within the scope of this theory. Certainly we have here an investigation of the problem which is both profound and highly suggestive. The book may therefore be heartily commended to all who interest themselves in the perplexing questions of auditory theory.

R. M. OGDEN

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War According to Clausewitz. Edited, with commentary, by MAJOR-GENERAL T. D. PILCHER. London: Cassell, 1918. Pp. 257.

This is a rather free translation of the first and most important work of Clausewitz, who died in 1831. It discusses the nature and theory of war, strategy in general, and finally the combat itself. It is a far broader work than Berhardi, and, while it stresses greatly what might be called the mechanics of war, it lays far more emphasis on morale than do most recent German writers.

G. STANLEY HALL

Le Courage. L. HUOT & P. VOIVENEL. Paris: Alcan, 1917. Pp. 358.

This is the broadest and most comprehensive treatise on the subject, its history, literature, manifestations in war and its psy-

chology, and sketches with great detail the inner history of a great conflict, its beginning, acme, and end. At the apex of his excitement the fighter's state is masochistic and he absolutely loses fear. There are other analogies between the erethism of war and that of sex. The author's main thesis is that courage is the triumph of the instinct of social over individual preservation. It abounds in very acute observations.

G. S. H.

France and the Next War. A French View of Modern War. J. COLIN. London: Hodder & Stoughton, 1914. Pp. 316.

Like nearly all the works of French writers everything here centers from the battle itself. This is a careful psychological study, especially of the Napoleonic wars, stressing morale from the standpoint of the battle.

G. S. H.

Le Combat. GENERAL PERCIN. Paris: Alcan, 1914. Pp. 301.

This book begins and focuses in the combat itself but describes the different kinds of fear in the various arms of the service, and in the last chapter moral forces, both material and intellectual to the advantage of the latter.

G. S. H.

The Principals of War. F. FOCH. (Trans. by J. de MORINNI.) N. Y.: 1918. Pp. 372.

Here we have the principles of Foch the Teacher which he has lived up to. The whole work is sown with references to morale, which is the force that most needs to be economized, that is regulated by intellectual discipline, that is affected by strategy. The last three chapters culminate, like all French works, in the battle itself.

G. S. H.

Hier et Demain. G. LEBON. Paris: Alcan, 1918. Pp. 252.

In this work the author applies his psychology of peoples and the crowd to war before and during battle, and seeks to give a practical application to his view that the force of the army is the force of collectivity, a view that underlies both his *The Psychology of Peoples* (N. Y., 1912, 216 p.) and his *Enseignements Psychologiques de la Guerre Européenne* (Paris, 1916, 364 p.).

G. S. H.

The Biology of War. G. F. NICOLAI. New York: Century, 1918. Pp. 553.

The author of this book, which is one of the very best the war has produced, was formerly professor of physiology in the University of Berlin, and suffered bitter persecution at the hands of the German government for printing his valuable work. Part I discusses the war instinct, war and the struggle for life, selection by means of war, the chosen people, how war is metamorphosed and the army transformed, the roots of patriotism, its different species, unjustifiable chauvinism, the legitimate individualism of nations, and altruism. Part II tells how war may be abolished, describes the evolution of the idea of the world as an organism and how this conception has been voiced, or rather how unsuccessful have been the attempts to express it, discusses the transformations of human judgment, and finally war and religion.

The author starts with a drastic arraignment of the ninety-three German professors who signed the famous German Manifesto of October, 1914, which prompted his book. He shows remarkable familiarity with the history of war, but the chief thesis with which his book concludes is that God is humanity, theology is anthropology, and in this way he redefines in modern form the conception first set forth by Feuerbach that all modern conceptions of God are really those of humanity ejected and projected upon the clouds. God is Man and therefore brotherhood and peace must evict war.

G. STANLEY HALL

Morale. H. GODDARD. New York: Doran, 1918. Pp. 118.

This is largely a reprint of articles but a most stimulating book for soldiers. The preliminary morales are health, gregariousness, and humor. The major are pugnacity, adventure, work, communal labor, justice; while the composite morales include pride, victory, sport, fatalism, and reason. Then comes the supreme morale, which is that of creation. Sex and Morale and Morale and Reconstruction are also included.

G. S. H.

Morale and Its Enemies. W. E. HOCKING. New Haven: Yale Univ., 1918. Pp. 200.

The author was at the front for a short time during the summer of 1917. The substance of this book was given in lecture courses. The first part treats of the Foundations of Morale, and includes

chapters on why morale counts and how much, what is good morale? its foundations—instinct and feelings, knowledge and belief, realizing the war, enmity, the purposes of Potsdam, the mote in our own eye, and state blindness. The second part deals with the Morale of the Fighting Man. Here are chapters on the psychology of the soldier, discipline, will, practice, command, morale-building forces, fear and its control, war and women, and the longer strains of war.

G. S. H.

The Psychology of Courage. H. G. LORD. Boston: J. Luce, 1918. Pp. 164.

The author is a professor at Columbia University. His book deals with mechanism in man, the nature of courage, its simpler and lower forms, acquired and complex mechanism in its higher forms, courage of differing patriotisms, its ultimate foundations, training—general and special, restoration of courage when lost, shell-shock, and an epilogue on morale.

G. S. H.

Making a Soldier. Major-General W. A. PEW. Boston: Badger, 1917. Pp. 220.

This book consists of lectures given informally at the monthly conferences of the Training School of the Massachusetts National Guard. The chief topics treated are discipline, knowledge and ideals, interest, the struggle, habits, instincts, pugnacity, education, play, self-assertion and self-abasement, gregariousness and fear, preparedness and the militia. This is a very vigorous, stimulating, and practical book.

G. S. H.

The Psychology of Handling Men the Army. J. PETERSON & Q. J. DAVID. Minneapolis: Perine Book Co. Pp. 146.

The junior author has had much experience, and the book treats mainly of competition, play, team-play, leadership, principles of learning, health, discipline, and loyalty. The book was submitted to the War Department, which authorized its publication.

G. S. H.

The Psychology of War. J. T. MACCURDY. London: Heinemann, 1917. Pp. 68.

This treats chiefly of primitive instincts and gregariousness and its correlation with primitive instincts. The author has made very important contributions in the base hospitals to the knowledge and treatment of shell shock.

G. S. H.

Morals and Morale. L. H. GULICK. (Intro. by R. B. FOSDICK.) Association Press, 1919. Pp. 192.

This book was practically finished before the author's death, and has been brought down to date by the most competent of all authorities. Dr. Gulick studied the sex problem at the front, and the last half of his book is made up of appendices, starting with the messages of President Wilson and Secretary Baker and containing the important documents which show just what our government has done for sex in the army. This is the best and most comprehensive work on the subject.

G. S. H.

Les Etudes sur le Combat. A. DU PICQ. Paris: Hachette, 1880.

Until Marshal Foch's book appeared, this has been probably the most characteristic presentation of the psychology of the actual face-to-face combat, which the French make central in their war theory and teaching just as the German works tend to center about maneuvers and tactics.

G. S. H.

Psychology of War. LEROY ELTINGE. Fort Leavenworth, Kans.: Army service schools, 1915. Pp. 126.

This is a very effective book and widely read by officers, based to some extent on LeBon's principles. The psychology of the crowd and mass is discussed, and there are excellent chapters on panic in war and on the psychology of infantry combat. In an appendix he discusses the causes of war, which bottom on the increase of population and economic pressure, and this, to the author, shows that war is inevitable.

G. S. H.

DISCUSSIONS

A NOTE ON VISION—GENERAL PHENOMENA

We wish to make the following corrections of Dr. Troland's review of work published by us during the year 1917-1918.

1. He says of our work on "The Power of the Eye to Sustain Clear Seeing under Different Conditions of Lighting": "Semi-indirect reflectors of high density seem to be most conducive to eye comfort." While this conclusion would perhaps be more agreeable and satisfactory to certain commercial and professional factions in lighting circles, it was not drawn by us nor can it be drawn from our results. Of the commercial reflectors tested by us thus far, unmodified by any experimental device for the improvement of their effect on the eye (cf. Opaque Direct Reflectors, *Trans. of Illum. Eng. Soc.*, 1917, 12, pp. 466-468), the best results have without question been obtained with the totally indirect reflectors.

2. Of our article, "Some Areas of Color Blindness of an Unusual Type in the Peripheral Retina," he says: "Ferree and Rand report observations which show that areas can be found in the peripheral visual fields of many persons which are relatively blind to red, green, yellow or blue but which are not correspondingly deficient in the complementary after-image and other related reactions." There is no ground for using the term "relatively blind" here. It was shown in the article reviewed that stimuli so intense as to carry the sensitivity to red, yellow and blue out to the limits of white light vision were not sensed as color in these areas. Further in order to leave no doubt as to their color blindness the series was made to include also stimuli so intense as to give colors greatly reduced in saturation when viewed in central vision. If areas so tested are to be called "relatively blind" it is difficult to understand why the term color blind should ever be used. What we actually reported was that both types of areas, color blind and color deficient, showing no detectable loss in the cancelling and after-image functions were to be found in the peripheral retina.

3. Our discussion of the "Needs and Uses of Energy Measurements in Psychological Optics" is represented in a way which we do not care to have stand uncorrected in the year's reviews of work. Our argument was that if we are to determine the sensitivity of the eye in a way that is comparable with the determination of the sensitivity of the physical recording instruments we should be able to compare numerically both our amounts of response and

amounts of stimulus. The question whether stimuli should be equated subjectively or in energy terms for investigations bearing on various points of theory or doctrinal conception was quite aside from the main purpose of the paper. Which type of equation should be used depends on the nature of the problem in hand, as was made clear as a feature of minor importance in the article reviewed. The need of a method logically sure for the determination of sensitivity was the particular point of emphasis and it was with reference to this point especially, which we believe is at present the most important in the laying of the groundwork of a more scientific psychophysics of vision, that our recommendation of energy measurements was made. In this connection it may be noted further that the article reviewed is in part a criticism of the reviewer's own advice that the eye may be used as a substitute for the nonselective instruments in the measurement of light energy; and that our criticism of this recommendation was not by any means based alone on the inadequacy of the "extant visibility data." These points are discussed in greater detail in two articles (Titchener Commemorative Volume, pp. 230-308 and *Psychological Monographs*, No. 103) which were not reviewed by Dr. Troland.

C. E. FERREE,
GERTRUDE RAND

BRYN MAWR COLLEGE

THURSTONE'S MEASURES OF VARIABILITY IN LEARNING

As an illustration of the seriousness of our present erroneous attitude toward the meaning of learning curves, the article by Dr. Thurstone in a recent number of the *BULLETIN*¹ is interesting. This is especially true in view of the careful mathematical training and habits of this investigator. In the article here indicated, reporting an analysis of the learning of telegraphy by 165 drafted men, it is discovered that the variability of the pooled results of the group of learners "increases with practice." These results are expressed in the number of words received per minute, and the increase in variability with practice is shown graphically both for the semi-interquartile range and for the standard deviation. "This," says the author, "is perhaps to be expected anyway by common sense for if a frequency surface of attainment be plotted at each successive stage of practice, the range should increase with practice

¹ THURSTONE, L. L.: Variability in Learning, *PSYCHOL. BULL.*, 1918, 15, 210-212.

while the frequencies should decrease to keep the areas of the curves constant. *Hence any measure of variability must increase with practice. Learners separate from each other more and more in attainment as they progress* " (p. 211). These last two sentences, which I have italicized, make statements which are questionable, statements which are true only for the absolute changes in the type of curve that I have called the average attainment curve (the "*a*-curve"), or for the data which such curves represent.¹ Such statements are not true for time or for error curves (the "*e*-curves"). In the case of the *e*-curves or of data expressed in errors or in time, as defined in the article referred to, the reverse is true: measures of variability must decrease with practice, and learners approach each other more and more as they progress. This is obvious from any study of learning curves that shows the simultaneous progress of several subjects,² if the curves represent changes in absolute units. The following curves, Fig. 1 and Fig. 2, are illustrative. They represent the progress of six subjects in a code-learning experiment carried out by the writer, with the aid of some advanced students, in the Jesup Psychological Laboratory. The subject in each case copied a continued story daily for exactly twelve minutes each period, M, P, and J writing for each letter in the words of the story its number in the alphabet; *e. g.*, "and" would be written 1-14-4. The other subjects, under precisely similar conditions, wrote the same story in the code used by the Southern Army in the Civil War, a code now used in the Goddard and the Terman revision of the Binet-Simon tests. The subject in each type of experiment was not permitted to have the code before him, but was to reproduce it ideally. Those subjects substituting numbers were frequently seen to employ their fingers in finding the correct number; but both these and the other subjects soon learned to establish certain points for orientation, as *e* = 5, *j* = 10, *o* = 15, *t* = 20. The two codes were found to be of about equal difficulty. Each subject practiced in a separate room in the laboratory occupied by himself and the experimenter, who read to him as needed the words of the story and marked successive seconds on the printed copy. Long words were spelled to the subject in the early part of the experiment so that the keeping of many letters in mind would not be distracting. Later on, the story was

¹ PETERSON, J.: Experiments in Ball-Tossing: The Significance of Learning Curves, *J. of Exp. Psychol.*, 1917, 2, 178-224.

² See, for example, WELLS, F. L., The Relation of Practice to Individual Differences, *Amer. J. of Psychol.*, 1912, 23, 75-78, for divergences of the *a*-curves; and PETERSON, J., *op. cit.*, pp. 188, 189, for convergences of the *e*-curves.

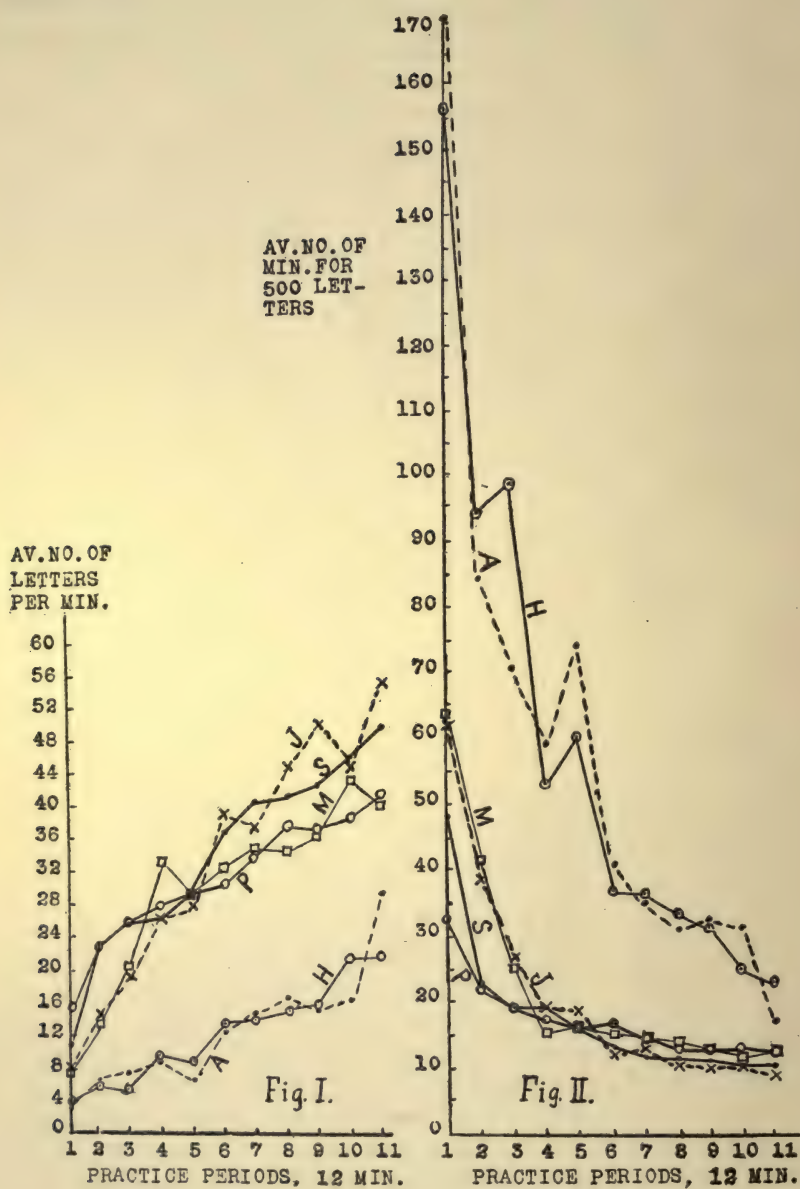


FIG. 1

FIG. 2

read by phrases, as the translation got more mechanical and the subject's attention went to the meaning. The subject was apprised each day of his errors in the preceding practice, and errors were not counted in the score. The subjects made very few errors after the first two days' practice.

Only correct translations were counted, every letter that was wrong being omitted in the count. Unfortunately the experiment could not be continued further, but the general trend is evident, though it is probable that the curves in Fig. 1 might again converge somewhat toward the so-called physiological limit.

In brief, the cause of the difference in trend of variability between *a*- and *e*-curves is, that average attainment always starts with small *absolute* amounts and changes toward larger absolute amounts, while the time to do a given amount of work, or the number of errors made in doing it, starts in large absolute amounts and changes toward smaller amounts. As the one type of measurement increases the other decreases; they are reciprocal relations, as I have shown in the article already cited. Any interpretation, therefore, based upon the absolute units ordinarily shown in graphs is liable to be erroneous, as in this case.

There are also questionable assumptions as to the equality of practice in successive practice periods, the effects of which on the curves we cannot here consider. If equal time practice periods are given we assume, probably wrongly, that the subjects get as much practice doing a little work in the beginning as he gets doing a great deal more, of the kind attempted, toward the end of the experiment. Roughly speaking, Dr. Thurstone's subjects seem to have averaged about 150 words each in the twenty-first period and about 390 in the seventy-second period. Are we sure that this is *equal* practice?

We may or may not grant that practice for *equal time periods* means equal periods of practice with varying degrees of ability, but there is still an obvious error in the conclusion under consideration, an error closely related to that pointed out above. Does the variability of the group, expressed either as the quartile range or as the standard deviation, increase with practice? The author concludes in the affirmative: "The variability evidently increases with practice" (p. 211). This statement is twice made, once interpreting the quartile range graph and once the graph of the standard deviation. Taking the author's smoothed curves, a rough estimate shows that the median number of words per minute

for the group is about 2.5 in the 21st hour and 6.4 in the 72d; that the quartile is about 1.5 in the 21st hour and 2.5 in the 72d; that the standard deviation is about 1.85 in the 21st hour and 3.3 in the 72d.

Therefore the coefficients of variability of the last two measures are .60 and .74, respectively, in the 21st hour and .39 and .52 in the 72d. Both of these measures, then, actually show a *decrease* in the coefficient of variability with practice, contrary to the conclusion drawn from the changes in absolute units shown on the graphs.

These facts illustrate how careful one must be in basing interpretations of changes in learning on graphs in absolute units. Mr. Thurstone's carefully plotted curves would seem to lend support, so far as they go, to my own contention elsewhere, that most cases of learning when properly interpreted probably advance about uniformly if application is kept constant and practice periods are made equal, whatever such equality may be found to mean. It is a question whether this is a legitimate inference from the graphs under consideration, and whether the author would agree to it.

It is regrettable that the subjects were removed before Mr. Thurstone completed his interesting experiment. We undoubtedly need some careful work done on plateaus and physiological limits in this type of learning.

JOSEPH PETERSON

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AN EASY METHOD OF DETERMINING THE COEFFICIENT OF CORRELATION

The tediousness of computing correlation coefficients by Pearson's "products moment" method has deterred many from undertaking investigations involving this puttery work. The figuring is, in a long problem, an Herculean task, demanding the utmost care and concentration. The necessity for such painstaking effort arises from two main sources; first, the necessity for taking account of algebraic signs; and, second, the considerable number of arithmetical computations which are demanded.

Thurstone (PSYCHOL. BULL., 14, 28-32) has already presented a method by which the first difficulty is obviated, for in his adaptation of Pearson's formula, no attention need be paid to algebraic signs unless they are indigenous to the experimental results themselves. Methods for reducing arithmetical computation have been suggested and a description of them may be found in practically any text on Statistical Methods. But as far as I have been able

to find in the psychological and educational literature, the two methods have never been put together. The combined method results in a considerable saving of time and energy. For this reason, a brief description of it will be pertinent.

1. The first step is to make a correlation table (see Table I).

TABLE I
X ARRAY
Accuracy of mind

<i>V</i>	Class								<i>f_v</i>	<i>f_v · V</i>	<i>f_v · V²</i>	
	2	3	4	5	6	7	8	9				
<i>y</i> array concentration.	2	2	3	5	2	1				13	26	52
	3			4	5	5				14	42	126
	4	1	1	19	28	12	1		1	63	252	1,008
	5		1	9	62	32	11	5	4	124	620	3,100
	6		1	2	28	22	24	3	3	83	498	2,988
	7			2	7	18	22	11	5	65	455	3,185
	8			1	4	7	17	23	5	57	456	3,648
	9				7	1	8	9	20	45	405	3,645
	<i>f_x</i>	3	6	42	143	98	83	51	38	464 = <i>n</i>	2,754 = Σ <i>y</i> 5.935 = Av. <i>y</i>	17,752 = Σ <i>y</i> ²
<i>f_x · V</i>	6	18	168	715	588	581	408	342	2,826 = Σ <i>x</i> 6.091 = Av. <i>x</i> .			
<i>f_x · V²</i>	12	54	672	3,575	3,528	4,067	3,264	3,078	18,250 = Σ <i>x</i> ²			

For convenience of reference, the x array is given in the columns and the y array in the rows.

2. The second step is to determine the frequency of the x array (f_x) by obtaining the sum of each column and the frequency of the y array (f_y) by obtaining the sum of each row. $\Sigma f_x = \Sigma f_y = n$, the number of measurements that have been entered in the table.

3. The third step is to multiply the frequency of each x column by the value (V) given at the top of the column. These values are given in Table I in the row labeled $f_x \cdot V$. $\Sigma f_x \cdot V = \Sigma x$ and Σx divided by n gives the mean or average of x . In a similar way Σy and the average of y are determined.

4. The fourth step is to obtain values for Σx^2 and Σy^2 . This is done by multiplying the frequency for each x column by V^2 , or as is usually easier, by multiplying $f_x \cdot V$ by V , and the result will be $f_x \cdot V^2$. The sum of these products ($\Sigma f_x \cdot V^2$) equals Σx^2 . In a similar manner the value Σy^2 is determined.

5. The fifth step is the determination of Σxy and this is the

only tedious part of the whole process. A simple method of determining this value is given in Table II. Each value of y , appearing to the left of the table, is multiplied by the sum of the values of x times the frequency appearing in that particular row. For example, consider the top row of the table. The y value is 2. Under the x value of 2 is found the frequency 2. These are multiplied,

TABLE II
DETERMINATION OF Σxy

	2	3	4	5	6	7	8	9	
2x	4+	9+	20+	10+	6			=	98
3x			16+	25+	30			=	213
4x	2+	3+	76+	140+	72+	7+		9=	1,236
5x		3+	36+	310+	192+	77+	40+	36=	3,470
6x		3+	8+	140+	132+	168+	24+	27=	3,012
7x			8+	35+	108+	154+	88+	45=	3,066
8x			4+	20+	42+	119+	184+	45=	3,312
9x				35+	6+	56+	72+	180=	3,141
									17,548 = Σxy .

2×2 , and the result set down in the corresponding square, then 3×3 is added to the first figure, and so on. The values for the entire first row are as follows:

$$2 \times (2 \times 2 + 3 \times 3 + 4 \times 5 + 5 \times 2 + 6 \times 1) = 98.$$

When a similar sum for each row has been obtained and these sums added, the desired Σxy has been obtained.

6. The sixth step is the solution of the formula given by Thurstone:

$$r = \frac{\Sigma xy - n \cdot \text{Av. } x(\text{Av. } y)}{(\Sigma x^2 - n \cdot (\text{Av. } x)^2)^{-2} (\Sigma y^2 - n \cdot (\text{Av. } y)^2)^{-2}}$$

Substituting, the equation becomes:

$$\begin{aligned} r &= \frac{17548 - 464 \times 6.091 \times 5.935}{(18250 - 464 \times 6.091^2)^{-2} (17752 - 464 \times 5.935^2)^{-2}} \\ &= \frac{17548 - 16774}{(18250 - 17214)^{-2} (17752 - 16344)^{-2}} = \frac{774}{(1036)^{-2} (1408)^{-2}} \\ &= \frac{774}{1208} = +.641. \end{aligned}$$

Futhermore, the standard deviation (σ) of the x array and the y array is easily determined from the data obtained in different parts of the problem. According to Davenport (*Statistical Methods* page 26), $\sigma = (\mu_2)^{-2}$, $\mu_2 = \nu_2 - \nu_1^2$, $\nu_1 = f \cdot V/n$, $\nu_2 = f \cdot V^2/n$. In the x array,

$$\nu_1 = 2826/464 = 6.091,$$

$$\nu_2 = 18250/464 = 39.4,$$

$$\sigma_x = (39.4 - 6.091^2)^{-2} = (39.4 - 37.1)^{-2} = 1.18$$

A much easier solution is obtained by considering the denominator of the fraction given by Thurstone's formula, for

$$\left(\frac{\sum x^2 - n(\text{Av. } x)^2}{n} \right)^{-2} = \sigma_x.$$

In this particular example, then, $\sigma_x = (1036/464)^{-2} = 1.18$.

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EDITORIAL NOTE.—Public acknowledgment is hereby made to those whose support and cordial coöperation made possible the publication of the BULLETIN during the past year. Despite other burdens added to their regular duties, there has been a ready response to calls for contributions and other assistance, and the editor takes this opportunity to make known his appreciation thereof.

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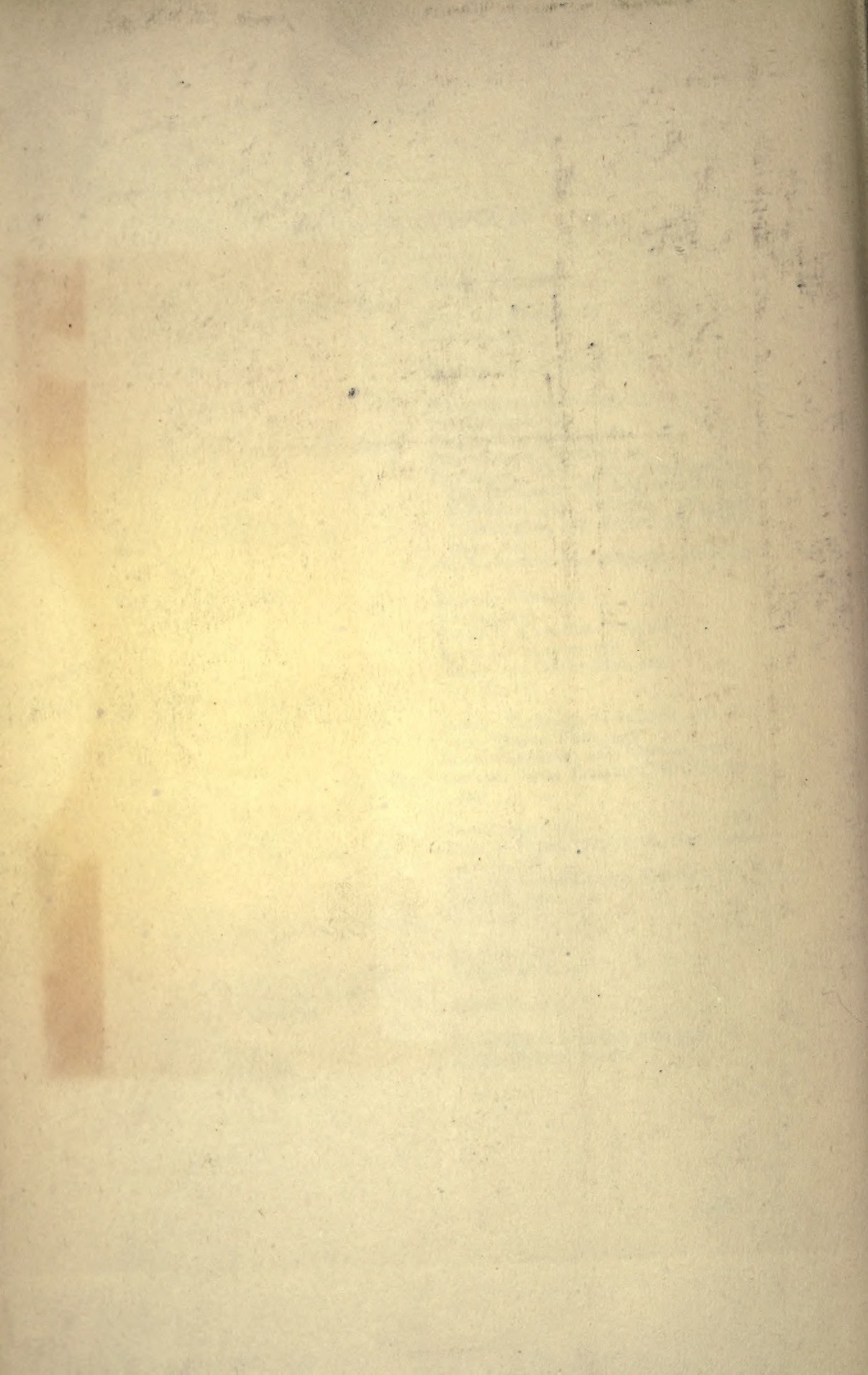
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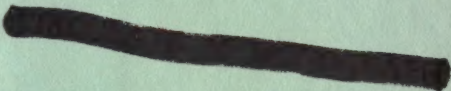
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